$25.00

Installation and Service Manual

SBD2/X Series
P.W.M. Motor Controller

M-8404 - Issue 11

NOTICE:

Upon receipt of the amplifier, closely inspect the components to ensure that no damage has occurred in shipment. If damage has occurred, notify the appropriate carrier at once.

CAUTION:

Dangerous voltages exist in this equipment. Do not attempt connecting or probing in this equipment with power on.

Should any question arise regarding any step outlined in this manual please call the factory.

INDUSTRIAL DRIVES
A
KOLLMORGEN
DIVISION
Radford, Virginia 24141

**THE ELECTRONIC COMPONENTS
IN THIS AMPLIFIER ARE
STATIC SENSITIVE. USE
PROPER PROCEDURES WHEN
HANDLING COMPONENT BOARDS.**

INSTALLATION AND SERVICE MANUAL

SBD2/SERIES
MOTOR CONTROLLER
M-8404
ISSUE 11

NOTICE:

Upon receipt of the amplifier, inspect the components and ensure that no damage has occurred in shipment. If damage has occurred, notify the carrier at once.

WARNING:

DANGEROUS VOLTAGES, CURRENTS, TEMPERATURES, AND ENERGY LEVELS EXIST IN THIS PRODUCT AND IN THE ASSOCIATED SERVO MOTOR(S). EXTREME CAUTION SHOULD BE EXERCISED IN THE APPLICATION OF THIS EQUIPMENT. ONLY QUALIFIED INDIVIDUALS SHOULD ATTEMPT TO INSTALL, SET-UP, AND OPERATE THIS EQUIPMENT.

WARNING:

INCORRECT MOTOR AND/OR RESOLVER WIRING CAN CAUSE ERRATIC OR RUNAWAY MOTOR OPERATION.

SAFETY FIRST

ONLY QUALIFIED PERSONNEL SHOULD WORK WITH THIS EQUIPMENT.

THE MOTOR THERMOSTAT IS AN AUTOMATIC RESETTING DEVICE AND WHEN APPLICABLE, MOST DEFINITELY SHOULD BE CONNECTED INTO A LATCHED (LOCKED-OUT) POWER DOWN TYPE CIRCUIT.

THE MOTOR OVERLOAD RELAY (CUSTOMER FURNISHED), IF SET TO THE AUTOMATIC MODE, SHOULD BE USED IN A LATCHED POWER DOWN TYPE CIRCUIT. THIS OVERLOAD DEVICE IS NORMALLY SET TO THE MANUAL MODE WHEN SHIPPED FROM INDUSTRIAL DRIVES.

PLEASE CHECK THE MOTOR OVERLOAD DEVICE TO INSURE THAT THE DEVICE IS IN THE MANUAL MODE.

DANGEROUS POWER LEVELS EXIST IN THIS EQUIPMENT. EXTREME CARE SHOULD BE EXERCISED WHEN INSTALLING TROUBLESHOOTING OR OTHERWISE WORKING WITH THE EQUIPMENT. DURING THE INITIAL "START-UP", BE PREPARED TO REMOVE THE MAIN POWER IF A MECHANICAL OR ELECTRICAL PROBLEM OCCURS. IF POSSIBLE, THE INITIAL "START-UP" OF THE EQUIPMENT SHOULD BE PERFORMED WITH THE MOTOR(S) DECOUPLED FROM ANY MACHINE COMPONENTS. IF THIS IS NOT PRACTICAL, PLEASE INSURE THAT ALL LIMIT SWITCHES AND OTHER <u>SAFETY SHUT DOWN DEVICES</u> ARE IN PLACE AND OPERATIONAL.

THE INFORMATION FOUND IN THIS INSTALLATION AND SERVICE MANUAL IS UPDATED FREQUENTLY DUE TO PRODUCT IMPROVEMENTS, ETC., AND MAY NOT CONFORM IN EVERY RESPECT TO FORMER VERSIONS OF THE EQUIPMENT IN THE FIELD.

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PREFACE

This Service and Installation Manual is a general document and is applicable to the entire SBD product line. However, since these amplifiers are interfaced with motors of varying sizes and different operating characteristics; such as internal resistance, inductance, rotor inertia, etc., the complete model numbers of the amplifiers will vary more or less with the motors they are made compatible with. Thus, after the amplifier is mated with a particular motor, along with a single-phase or three-phase isolation transformer to form a complete Rate Loop System, the model number applied to the amplifier nameplate may be understood to be the basic model number for the system.

The Test Limits and Modification Sheet (TL) is a specific document and is applicable only to individual systems or axis sections. The TL Sheet contains such information as maximum operating speed, peak current limits, and the component compensation values which make a particular amplifier compatible with the motor.

The TL Sheet will be found in the inside pocket of the front cover of the manual shipped with each amplifier package. Some packages may contain more than one motor control section to form a multi-axis drive package. In such cases, there will be as many TL Sheets as there are various types of motors.

SBF(A)
SINGLE BOARD FRAME ASSEMBLY
MODEL NUMBER SCHEME

Example: SBF(A) B/C-D-EGH
Refer to Figures 1 and 2

SBF .... Single Board Frame

A .... Power Supply Option

P .... Main Bus and Logic Power Supplies

H .... Main Bus Power Supply Only

L .... Logic Power Supply Only

NOTE: IF P,H, OR L ARE NOT INDICATED, THERE IS NO MAIN BUS OR LOGIC POWER SUPPLY.

B - 1,3 .... Generation

C .... Single Board Spacing Options (Examples)

5x2" .... 5 Axis, 2" Spacing (19" Frame)

3x4" .... 3 Axis, 4" Spacing (19" Frame)

2x6" .... 2 Axis, 6" Spacing (19" Frame)

446 .... 3 Axis, Two 4" and One 6" Spacing

22244 .... 5 Axis, Three 2" and Two 4" Spacing

22226 .... 5 Axis, Four 2" and One 6" Spacing

222224 .... 6 Axis, Five 2" and One 4" Spacing

R .... Regeneration Module, One 2" Spacing

D - 48, 60 .... Continuous Current Rating

E - .... Main D.C. Bus Voltage Rating

1 160

2 225

G - .... Phase Option

1 .... Single Phase Input Power

3 .... Three Phase Input Power

H - .... Other Options

000 .... No Option

001 .... Special Oversized Framework

To create a Single Board Multi-Axis sytem from the SBF(A) assembly, the appropriate Single Board Drive (amplifier) (SBD2 or SBD4*, etc.) dimensions must be considered. Also, if a SBR1 Single Board Regeneration (Module) is reguired, its dimensions must be considered.

Example: SBFP3/222R-48-23000

Interpretation of the above model number reveals the following:

P) The SBF contains a Main Bus and Logic Power Supply.

3) The SBF is a 3rd Generation Single Board Frame Assembly.

2222R) The SBF contains four SBD2 modules and one SBR1 (Single Board Regeneration Module).

48) The SBF Main Bus Power Supply is rated at 48 amps continuous.

2) The SBF Main Bus Power Supply is rated at 225 volts.

3) The SBF input power is from a 3 phase source.

000) There are no options.

NOTE: 1

The SBD2 amplifiers are rated at 01, 06, 10, 16, and 20 amps continuous and are all 2" packages (Covered in Installation and Service Manual, M-8404). The SBD2 amplifiers may be mounted in the SBF "Single Board Frame" assembly or mounted as stand-alone units.

*The SBD4 amplifiers are rated at 30, 45, and 60 amps continuous. The 30 and 45 amp units are 4" packages. The 60 amp unit is a 6" package (Covered in Installation and Service Manual, M-8508). The SBD4 amplifiers may be mounted in the SBF "Single Board Frame" assembly or mounted as stand-alone units.

The SB(R)1 Regeneration Module is a 2" package. It may be mounted in a SBF "Single Board Frame" assembly or mounted as a stand-alone unit.

The SBP(R)1 Power Supply with Optional Regeneration Module may be mounted as a stand-alone unit only.

SBD2
SINGLE BOARD DRIVE (AMPLIFIER)
MODEL NUMBER SCHEME

Example: SBDA-B-CD-E/F-G
Refer to Figure 3

SBD	Single Board Drive (Amplifier)
A - 2	Generation
B - 01, 06, 10, 16, 20	Contiuous Current Rating
C	Standard Maximum Output Voltage
1	160
2	225
*D	Option
101	O.K. to Enable & Enabled Output Relay Contacts and Precision I^2t Foldback Circuit
102	Same as 101, but with Direction Limits
103	Same as 101, but with Tach Loss Circuit
105	Same as 101, but with Variable Gain Compensation Card. Operates at 6.8khz
106	Same as 102 w/Tach loss SBD2-TL1 Card
111	Same as 101, but with Dual Compensation Card
112	Same as 111, but with Direction Limits
123	Using SBD2-COMP VG1 Comp Board and SBD2-TL1 Card

	135	Comp Card w/Gain Changer and Fault Detector
	200	OPTO-Isolated Enabled Outputs and Standard I^2t Circuit (UL - N/A)
	201	Relay Enabled Outputs & Precision I^2t Circuit (UL - N/A)
	202	Directional Limit (UL - N/A) + 102
	210	Same as 200 w/Dual Compensation
	211	Same as 201 w/Dual Compensation
	212	Directional Limit (UL - N/A) + 112
E		Motor Compensation Code
F		Compensation Voltage: 90, 120, 160, 180 or 225
G		Compensation Current: 01, 06, 10, 16, or 20

NOTE:

1 - ALL SBD2 units operate at a 10 khz switching frequency except:
- **I. The 1 amp continuous units which operate at 15khz.**
- **II. The 105 units which operate 6.8khz.**

2 - SBD2 amplifiers compensated to operate on Bus Voltages of 70 to 160 volts, when powered from a 160 vdc supply, will have their under volts fault latches set to trip at approximately 60 volts and their over volts fault latches set to trip at approximately 225 volts.

3 - SBD2 amplifiers compensated to operate on Bus Voltages of 110 to 225 volts, when powered from a 225 vdc supply, will have their under volts fault latches set to trip at approximately 100 volts and their over volts fault latches set to trip at approximately 300 volts.

*FOR UNIT WITH MATING CONNECTORS, PUT "3" AS FIRST DIGIT FOR NON-UL, OR "4" AS FIRST DIGIT FOR UL UNITS. EXAMPLE: 300 (NON UL) 400 (UL)

NOTE: SBD2-FDB EXTERNALLY MOUNTED **FAULT DETECTION BOARD** AVAILABLE

SBR1
SINGLE BOARD REGENERATION MODULE
MODEL NUMBER SCHEME

Example: SB(A) B-C-E
Refer to Figure 5

SB . . . . Single Board (Regen Module)

A - . . . . Regeneration Only

B - . . . . Generation

C - . . . . Options

  1000 . . . . Standard 160 Volt Unit

  2000 . . . . Standard 225 Volt Unit

E - . . . . D. C. Bus Level

  160 . . . . 160 Volt Regulation

  225 . . . . 225 Volt Regulation

Sometimes, this module will be combined with the SBP1 Power Supply Module to form the SBP (R) 1 Module, shown in Figures 7 and 8 (25 amp unit).

SBR1
SINGLE BOARD POWER SUPPLY AND REGENERATION MODULE
MODEL NUMBER SCHEME

Example: SB(A) (R)B-C-EGH
Refer to Figures 6, 7, and 8

SB .... Single Board (P.S./Regen Module)

- A .... Power Supply Option
- P .... Main Bus and Logic Power Supplies
- H .... Main Bus Power Supply Only
- L .... Logic Power Supply Only
- R .... Regeneration Module Option
- B - 1 .... Generation
- C - 15,25,48 .... Continuous Current Rating
- E .... Main D.C. Bus Voltage Output
  - 1 160
  - 2 225
- G .... Phase Option
  - 1 .... Single Phase Input Power
  - 3 .... Three Phase Input Power
- H .... Cooling Option
  - 000 .... With Fan
  - 001 .... Without Fan

Sometimes, this Stand Alone module will be combined with the SBR1 Regeneration Module, shown in Figure 5, to form the SBP(R)1 Module, shown in Figures 7 and 8 (25 amp unit)

1.0 INTRODUCTION

The SB (Single Board) pulse-width-modulated servo amplifiers are offered in a basic "building block" concept. Designed and manufactured by INDUSTRIAL DRIVES to offer versatility to the market place around a single motor control module (see Figures 2, 3, and Outline & Dimension Drawing C-80447).

With exception of the power supplies each SB (Single Board) unit is itself a complete motor controller. These Single Board motor controllers are offered in several sizes and configurations. The SB1, SB6, SB10, SB16, and SB20 are single board servo amplifiers with 1A/2A, 6A/12A, 10A/20A, 16A/32A, 20A/40A (continuous/peak) current ratings. These SB units operate on numerous bus levels from 70 to 225 volts. Each SB is a single servo amplifier module which may be supplied with mating connectors directly from connector houses or obtained as customer furnished items from INDUSTRIAL DRIVES (See Appendix A for connector information). The customer may wish to furnish the DC bus and $\pm$12 volt regulated power supplies for the control logic, or purchase these with amplifier to form a complete SBD (Single Board Drive) system. One power supply module can supply all the voltages necessary, along with the regeneration circuitry,to support as many as 6 different SB motor control modules. (See Appendix B for $\pm$12 volt logic and main bus power supply information).

In the SBD (Single Board Drive) system, up to six SB's (Single Boards) can be incorporated into a 19 inch rack complete with the necessary power supplies or the customer may elect to furnish these power supplies. (See Appendix B for information on stand alone power supplies). A dual compensation board is also available to allow switching between two motors from a single SBD amplifier. The SBD amplifiers are downward compatible and may be interchanged provided the proper compensation board is installed. With the SBD system, customers have the flexibility of selecting the proper size of individual SB motor controllers for a variety of applications.

Motor Overload Relays (and in some applications, Dynamic Braking) are recommended. INDUSTRIAL DRIVES has these options available whenever your application may require them.

Some of the SBD2 ratings are application dependent in the areas of mounting configuration and air flow. If in doubt about your application, please let our applications department assist you.

1.1 Self Protection

The SBD amplifiers are fully protected against a variety of fault conditions for improved reliability:

Over Current Protection

- Motor line shorted to ground
- Short across the motor terminals
- Motor peak current foldback

Over Voltage Protection

- Application of excessive power bus
- Excessive power bus pump-up due to regeneration

Under Voltage Protection

- Insufficient power bus voltage.
- Loss of $\pm$12 volt control voltage.

Thermal Shutdown Protection

- Excessive heatsink temperature.

  To reset the SBD2, remove and reapply power to the unit.

2.0 MOUNTING

Refer to the Appropriate Outline & Dimension Drawings.

The SBD motor control modules may be individually mounted as single-axis motor controllers (customer furnished fans) or obtained within a rack to form a multi-axis drive system. The regeneration module (application dependent) can

support up to 6 SB motor control modules. The power supplies, typically can likewise support up to 6 SB motor control modules. The regeneration and power supply moduels may also be located within the rack panel or may be individually mounted. The power supply and regeneration modules are optional furnished items. For best reliability, it is recommended that all of the modules be mounted in their vertical up-right position.

3.0 WIRING

Refer to the Appropriate System Wiring Diagrams and Figures in the back of this Manual.

IN ORDER TO ADHERE TO SUITABLE ENGINEERING PRACTICES, IT IS RECOMMENDED THAT THE CONTROL VOLTAGE (115V AC FOR THE $\pm$12V BUS) BE APPLIED FIRST IN ORDER TO ACTIVATE THE CONTROL AND FAULT CIRCUITS BEFORE APPLYING THE MAIN BUS.

Reference to the NOTES on the appropriate System Wiring Diagram will aid in correctly "wiring the system up."

The following precautions are recommended:

1. Twist all A.C. leads to minimize electromagnetic emission and pick-up.

2. Avoid running signal leads (shielding recommended) in close proximity to power leads, armature leads, or other sources of electromagnetic noise.

3. Minimize lead lengths as much as practical.

4. Double-check all wiring. Carefully inspect all connections.

5. Connect the SBD wiring according to the appropriate wiring diagram, paying close attention to the grounding scheme.

3.1 Grounding Scheme

Each SBD amplifier common is made via the main bus supply common. The main bus supply common should be connected to the system ground point. DO NOT DAISY CHAIN THE GROUND RUN BETWEEN SEPARATE SBD UNITS.

3.2 Power Inputs

When the power supplies are not furnished by INDUSTRIAL DRIVES, flying leads are provided for hook- up. Also connector kits may be obtained directly from connector vendors (see Appendix A) or ordered from INDUSTRIAL DRIVES DIVISION.

When utilizing the Frame Assemblies, the main bus high should be connected to C15-3 of the SBD2 units. The main bus common should be connected to C15-1 of the SBD2 units.

The control power supply should be connected to the SBD2 amplifier in the following manner:

+12 volts to Connector LS-1.
Common to Connector LS-2
-12 volts to Connector LS-3

The 3-phase transformer Y secondary may be connected directly to the diode bridge without regard to line phasing for the main power supply. (Refer to Frame Assembly Schematics C-80316-1 or C-80481, and Figures 1 and 2).

A 115V AC source must be connected to the $\pm$12 volt power supply card connector C14 at pins P & R.

For the stand alone modules, refer to Figures 3,5,6,7,8 and Drawings C-80446, C-80770, and C-80636.

3.3 Motor and Tachometer Connections

The tachmometer leads should be a shielded pair and should be terminated at Connector I/O -2 and 3.

The motor armature leads should be twisted when possible and should be terminated at Connector C12-1 and 3.

CAUTION: To avoid runaway the motor and tach must be phased properly.

Before applying power to the SB amplifier make the following servo polarity check. With a voltmeter on a sensitive VDC scale (3 volts or so), place the black lead on connector C12-1 and the red lead on connector C12-3 or if a connector is not used place the black lead on the stud marked ML (motor low) and the red lead on the stud marked MH (motor high). Have an assistant rotate the motor shaft and note the polarity indicated by the meter.

Next, place the black lead on Connector I/O -2 and the red lead on Connector I/O -3. Have an assistant rotate the motor shaft once again in the same direction and note the polarity indicated by the meter is opposite that of the previous step; if not, reverse the tach or motor leads.

If the motor moves in the wrong direction when the power is applied, remove power and reverse both motor and tach leads.

3.4 Signal Inputs and Modes of Operation

TERMINATIONS TO CONNECTOR I/O:

SIGNAL AND SHIELD COMMONS may be terminated at I/O -1,8,13 and 16. (Shields should be grounded at one end only).

The TACHOMETER FEEDBACK SIGNAL is terminated at I/O -3 with respect to I/O -2.

The CURRENT MONITOR waveform may be observed at connector I/O -4. There is a direct relationship between this waveform and the actual motor current. A D.C. voltmeter placed between I/O -4 and common (calibrated in either current or lb.ft) can serve as a means by which the constant load levels placed on the motor may be monitored. The current scale factor at I/O -4 may be determined by the following chart:

Amplifier	Peak-Current	Voltage-at-I/O-4 at-Peak-Current
SBD2-01	02	6.5
06	12	6.5
10	20	6.5
16	32	6.5
20	40	6.5

The COMP SWITCH input at I/O -5 when taken low changes the internal compensation for alternate motor control. This input is utilized when the SBD servo amplifier is equipped with the optional dual compensation board and used to control two separate motors.

The DIRECTION LIMITS at I/O -6 and 7 must be held low during normal operation. These inputs are intended to be incorporated into the overall machine protection scheme, such as over-travel limit switches, etc. When either of these inputs transition high continued motion will be prevented, while allowing movement in the opposite direction. The DIRECTION LIMITS circuitry is optional and may not be installed on the SBD2.

The EXT. LIMIT input at I/O -10 is taken low when external control for the reduction of motor torque is desired. When this input is taken high full motor torque is restored. The EXTERNAL CURRENT LIMIT circuitry is optional and may not be installed on the SBD2.

The ENABLE input at I/O -11 when held low serves as the SB amplifier ENABLE. When I/O -11 transitions high the amplifier becomes INHIBITED.

The TORQUE HOLD input at I/O -12 when pulled low converts the SB amplifier from a constant velocity (speed proportional to a command input signal) to a constant torque (torque proportional to a command input signal) system. The Torque Hold mode of operation may be utilized when the motor is required to dwell against hard stops or operate in a tension control system.

The Velocity Input Signal (max. $\pm$8V) is applied to the Diff. Hi with respect to the Diff. Lo inputs at I/O -14 and I/O -15, except when the SBD2-Comp VG1 Board Option is utilized. See Figure 9 and Drawing C-82067-1.

TERMINATIONS TO OUTPUT CONNECTOR:

The O.K. TO ENABLE at Output -1 and 3 when low (closed) is an internal indication to the outside world that no faults exist within the SBD amplifier and that the ENABLE mode may be initiated.

The ENABLED at Output -4 and 5 when low (closed) is an internal indication to the outside world that the SB amplifier is presently in its ENABLED mode or when this output is high is an indication that the SB amplifier is presently in its INHIBIT mode.

The standard SBD amplifier will have a relay output for O.K. TO ENABLE and ENABLED. An Opto Coupler output is optional.

4.0 PRELIMINARY CHECKS

Refer to the Appropriate System Wiring Diagram.

Once the SBD system has been installed and wired in continue with the Preliminary-Check-Out procedure to ensure proper operation.

The following equipment will be required:

- Adjustable signal source 0 to $\pm$ 8V DC @ 10ma.
- D.C. voltmeter (Simpson or Triplett, etc.)

4.1 Power Transformer Hook-Up

Before applying the main power do the following:

- Open the power circuit of the isolation transformer secondary by removing the fuses or disconnecting the wiring from the diode bridge of the main bus power supply.
- Apply power. Monitor the line-to-line voltage of the three-phase secondary to ensure that it is correct and that the transformer has wired correctly. Remove power.
- Reconnect the transformer secondary to the diode bridge of the main bus power supply. Disconnect the connector C15 from the SBD unit(s). Apply power. Monitor the main bus voltage at the loose connector to ensure that it is correct. Remove power. Allow approximately 2 minutes for the power stage capacitors to discharge. Reconnect connector C15 to the SBD unit(s).

> **NOTE: IN THE CASE OF SB MULTI-AXIS SYSTEMS, IT IS RECOMMENDED THAT THE SYSTEM BE CHECKED OUT ONE AXIS SECTION AT A TIME. AXIS SECTIONS NOT BEING CHECKED SHOULD BE INHIBITED BY REMOVING CONNECTOR C-15.**

Begin the initial start-up of the axis section with the control input circuitry disconnected, using the adjustable D.C. signal source instead. In this fashion, the velocity loop SB amplifier can be individually checked without complications from the control circuitry. It is also recommended that the load(s) be disconnected from the motor(s).

Apply power, and enable the SB unit, being ready to switch off the main power if runaway occurs. If the motor sits still and the results to this point are satisfactory, proceed. If the motor runs away, recheck the motor tach phasing per Section 3.3.

Using the adjustable D.C. signal source, and starting with a small signal, apply a command to the input of the amplifier. Run the motor first in one direction then the other. Have an assistant help observe the operation of the motor. The motor should accelerate and decelerate with quick crisp response and run with constant speed for any given input signal level.

DO NOT RUN THE MOTOR IN EXCESS OF THE MAXIMUM SPEED SPECIFIED BY THE TL SHEET FOR THE SYSTEM

4.2 Connecting the N/C or C/N/C

Remove the power. Remove the D.C. signal source and connect the Control input signal. Reconnect the load to the motor shaft.

CAUTION: INCORRECT SERVO TO POSITION LOOP PHASING CAN CAUSE LARGE EXCURSION OSCILLATIONS OR RUNAWAYS.

Appropriate precautions should be taken to stop the machine if necessary. Slides, etc. should be moved a reasonable distance away from hard stops before applying power.

Apply power and observe the action of the machine. If it is determined that the direction of rotation of the motor is reversed, or runs in the wrong direction, remove power and reverse both the tach leads and the motor armature leads.

5.0 ADJUSTMENTS

Refer to Figures 1, 3, 5, 8, 9, and 10.

There are eight adjustments in the standard SBD motor control system at the present time. Only unsealed pots need to be adjusted at the time of start-up. When it becomes necessary to make the sealed adjustments, they should be made in the following order:

5.1 Power Supply Adjustments (Factory Set and Sealed)

Refer to Figure 1, Figure 8, and Drawing C-80132-1.

With a D.C. voltmeter monitor the +12 volt test point (TP13A) on the SBD1-PS1 power supply card. Adjust Pot 10 for +12 volts ±100mv. Monitor the -12 volt test point (TP13C). Adjust Pot 29 for -12 volts ±100mv.

> **NOTE: THE POWER SUPPLY IS OPTIONAL AND MAY NOT BE SUPPLIED BY INDUSTRIAL DRIVES.**

5.2 Regeneration Module Adjustments (Factory Set and Sealed)

Refer to Figures 5, 8, and Drawings C-79668-1 or C-80737-1.

For SBD2 amplifiers using bus levels of 160 volts or less, the ACS-REG2 board should be adjusted in the following manner:

With a D.C. voltmeter, monitor TP6 on the ACS-REG2 or TP38 on the ACS-REG1 board. Adjust Pot 20 or (Pot 26) for +6.38 volts. With a D. C. voltmeter, monitor TP27 on the ACS-REG2 or TP30 on the ACS- REG 1 board. Adjust Pot 19 or (Pot 27) for +8.0 volts.

When the SBD2 amplifier is utilized with bus voltages up to 160 volts, then the maximum level to which the bus will be allowed to rise during regeneration will be limited to approximately 225 volts.

For SBD2 amplifiers using bus levels above 160 volts, but not more than 225 volts, the ACS-REG2 board should be adjusted in the following manner:

With a D.C. voltmeter, monitor TP6 on the ACS-REG2 or TP38 on the ACS-REG1 board. Adjust Pot 20 or (Pot 26) for +6.38 volts. With a D.C. voltmeter, monitor TP27 on the ACS-REG2 or TP30 on the ACS- REG1 board. Adjust Pot 19 or (Pot 27) for +8.2 volts.

When the SBD2 amplifier is utilized with bus voltages between 160 and 225 volts, then the maximum level to which the bus will be allowed to rise during the regeneration cycle will be limited to approximately 300 volts.

5.3 **Speed Scale Factor Adjustment** (Position Loop Machines)

Monitor the input at Diff. Hi with respect to Diff. Lo at the rear of Connector I/O -14 and 15 (refer to System Wiring Diagram C-80446 or C-80312) with a D.C. voltmeter. EXCEPTION: When the SBD2-COMP VG1 Board is utilized, refer to Figure 9 and Drawing C-82067-1, then follow the same procedure.

Command maximum traverse speed from the N/C or C/N/C.

Adjust Speed Scale Pot 28, located on the Compensation Card, to obtain the voltage level which the Control normally delivers at maximum traverse speed. If the "following error" is displayed by way of read-out, simply adjust the Speed Scale Factor Pot for the proper amount of "following error" (Refer to Figure 3).

5.4 **Speed Scale Factor Adjustment** (Manually Operated Machines)

Monitor the input at Diff. Hi with respect to Diff. Lo at the rear of Connector I/O -14 and 15 (refer to System Wiring Diagrams C-80446 or C-80312) with a D.C. voltmeter.

Apply command signal of the desired voltage level (4 to 8 volts) which represents maximum traverse speed. Adjust the Speed Scale Factor Pot 28, located on the Compensation Card, for maximum traverse speed. EXCEPTION: If the SBD2-Comp VG1 Board is utilized, refer to Figure 9 and Drawing C-82067-1, then follow the same procedure.

5.5 **Velocity Loop Zero Adjustment** (Position Loop Machines)

Monitor the input at Diff. Hi with respect to Diff. Lo at the rear of Connector I/O -14 and 15 (refer to System Wiring Diagrams C-80446 or C-80312) with a D.C. voltmeter.

Command zero speed from the N/C or C/N/C. If there is a small amount of signal level present, adjust the Velocity Loop Zero Pot 6, located on the Main Card, for zero volts on the meter. (Refer to Figure 3)

> Optional: If the "following error" is displayed by way of read-out, simply adjust the Velocity Loop Zero Pot for zero following error at zero speed.

EXCEPTION:	When the SBD2-Comp VG1 Board is utilized, refer to Figure 9 and Drawing C-82067-1, then follow the same procedure. (Pot 6 on the SBD2 Board is not used).

5.6 Velocity Loop Zero Adjustment (Manually Operated Machine)

Monitor the input at Diff. Hi with respect to Diff. Lo at the rear of connector I/O -14 and 15 (refer to System Wiring Diagrams C-80446 or C-80312) with a D.C. voltmeter. With the input signal at zero volts adjust the Velocity Loop Zero Adjustment Pot 6, located on the Main Card, for zero speed (refer to Figure 3).

EXCEPTION:	If the SBD2-Comp VG1 Board is utilized, refer to Figure 9 and Drawing C-82067-1, then follow the same procedure. (Pot 6 on the SBD2 Board is not used).

5.7 A. C. Gain Adjustment

In many cases, this pot may be turned fully CCW and disregarded. However, if necessary, the A.C. Gain Pot, located on the Compensation Card, can be used to increase the A.C. Gain of the servo loop. With an oscilloscope, monitor the "I MONITOR" signal at the rear of Connector I/O -4 (refer to System Wiring Diagrams C-80446 or C-80312). Accelerate and decelerate the motor at approximately 50% of maximum speed. Starting from a fully CCW position adjust the A.C. Gain Pot slowly CW to obtain optimum dynamic response. While accelerating and decelerating the motor and slowly adjusting the pot CW, watch for indications of instability in the current waveform.

CAUTION:	**Increasing the A.C. Gain too much may cause the system to go unstable.**

5.8 Current Sample Offset Adjustment

Factory Set and Sealed, Refer to Figures 3, 4, and Drawing D-81235

Remove power. Place a jumper between TP45-3(VLI) TP45-8(VLO), (Refer to Figure 3). With an Oscilloscope, monitor the SBD I/O Connector at Pin 4(I-Monitor). Apply power and Enable the amplifier. Adjust Pot 36B so that the waveform is equally centered above and below a zero centered baseline trace of the oscilloscope. Remove power and remove the jumper.

5.9 External Current Limit Adjustment (Refer to Figure 9)

The External Current Limit adjustment applies only when the SBD2-COMP VG1 Board is utilized.

When the optional External Current Limit circuit is installed and Pin 10 of Connector I/O on the SBD2 amplifier has been pulled low; reduction of motor current will be in effect. With a step input command signal, accelerate and decelerate the motor at some medium speed. With an oscilloscope, monitor Pin 4 (I-Monitor) of Connector I/O on the SBD2 (Is accessible at the back side of the connector). Adjust Pot (6) on the SBD2-COMP VG1 Board for desired peak current. Refer to Section 3.4 for current scaling at Connector I/O -4.

5.10 Current Limit Adjustment (Refer to Figure 9)

The Current Limit adjustment applies only when the SBD2- COMP VG1 Board is utilized.

When the optional SBD2-COMP VG1 is installed, means for adjusting the peak current is available. With a step input command signal, accelerate and decelerate the motor at some medium speed. With an oscilloscope, monitor Pin 4 (I- Monitor) of Connector I/O on the SBD2 (accessible at the back side of the connector). Adjust Pot (7) on the SBD2- COMP VG 1 Board for desired peak current. Refer to Section 3.4 for the current scaling at Connector I/O -4.

5.11 Compensation Adjustment (Refer to Figure 9)

The Compensation Adjustment applies only when the SBD2-COMP VG1 Board is utilized.

When the optional SBD2-COMP VG1 Board is installed, a means for adjusting velocity loop response is available. With a step input command signal, accelerate and decelerate the motor at approximately 25% of maximum speed. With an oscilloscope, monitor Pin 3 (tach signal) with respect to 2 of Connector I/O on the SBD2 (accessible at the back side of the connector). Adjust Pot (11) on the SBD2-COMP VG1 Board for desired response. Turn Pot (11) c.c.w. for maximum damping effect.

5.12 Balance Adjustment (Refer to Figure 10)

The Balance Adjustment applies only when the SBD2 TL1 Board is utilized.

When the optional SBD2 TL1 Board is installed, a means for balancing a scaled motor voltage sample is provided. Monitor TP28 on the SBD2 TL1 Board with a D.C. voltmeter. Run the motor at 50% of maximum speed and adjust Pot (35) for zero volts on the voltmeter. Run the motor in the opposite direction, TP28 should be approximately zero volts.

5.13 Tach Loss Trip Level Adjustment (Refer to Figure 10)

The Tach Loss Trip Level Adjustment applies only when the SBD2 TL1 Board is utilized.

When the optional SBD2 TL1 Board is installed, a means for setting the tach loss trip point is provided. Adjust Pot (30) fully c.c.w. Remove Jumper JR31 from Pins 2 to 3 on the SBD2-TL1 Board. Run the motor to 200 r.p.m. Adjust Pot (30) c.w. until the system just shuts down. Remove power. Reinstall Jumper JR31 at Pins 2 to 3 on the SBD2 TL1 Board.

> EXCEPTION:
>
> If the SBD2 TL1 Board is used only to generate a signal proportional to motor speed, to provide for current limiting as a function of speed, Pot (30) will be rendered ineffective. This is normally done when the SBD2 motor controller is utilized as a power amplifier only with no velocity loop mode of operation.

6.0 SIMPLIFIED THEORY OF OPERATION

The SB amplifiers are "Velocity Loop" amplifiers. A Velocity Loop amplifier is a device that maintains a speed proportional to a command input signal level.

A single-axis SBD amplifier consists of five (5) basic modules.

1. SBD Drive Hybrid
2. Modulation Hybrid
3. Comp. Module (SBD2-COMP2)
4. Main Board (SBD2-MC2)
5. Heat Sink

The SBD Drive Hybrid performs the Analog Interface Current Control, Direction Limits, Overspeed Shutdown, and Fault Monitoring functions.

The Modulation Hybrid receives the current output signals from the SBD Drive Hybrid and transforms these analog signals to pulse-width modulated signals. The pulse-width modulation signals are then applied to the base-drive circuits which control switching of the large single power transistor stages.

The Compensation Module contains the speed and A.C. gain adjustments, the current limiting circuits, and the lead and lag networks for proper velocity and current loop performance and compatibility.

The Main Board, into which the other three (3) modules are inserted, contains the following:

1. The Velocity Loop for precise speed control.

2. The optional Low Pass Filter which acts to block the high frequency components to prevent armature-tach (torsional) resonance.

3. The optional I^2t or standard R.M.S. Current Roll-Back circuits.

4. The Direction Limit Activating circuits.

5. The Current Sample Feedback Network

6. The O.K. to ENABLE and ENABLED circuits.

7. The Main Bus, Control Bus, and Over Temperature Monitoring circuits.

8. The D.C. to D.C. Converter.

9. The Base Drive circuits.

The Heat Sink assembly, onto which the Thermostat and Power Transistors are mounted, serves as the Power Stage. Other modules such as the Main Bus Supply, the Control Bus Supply and the Regeneration unit (ACS-REG2) are mounted elsewhere. See Figures 1,3,5,6,7,and 8.

7.0 TROUBLESHOOTING HINTS

In this section it is understood that some fault is suspected to exist within the SBD amplifier.

The best defense against down time is to keep on hand one or more complete spare SBD amplifiers. Since the SBD units are downward compatible (units of larger capacity may be used to replace smaller units) they are directly interchangeable provided the proper compensation board is installed.

Some recommended equipment for troubleshooting the SBD amplifier is as follows:

1. Adjustable Signal Source 0 - ± 10V DC (small 9V DC battery with input and reversing switches will do).

2. Dual Trace Oscilloscope.

3. D.C. Volt-Ohmmeter

4. One (1) 33K resistor with mini-alligator clip at each end.

5. One (1) 120K resistor with mini-alligator clip at each end.

Before beginning the troubleshooting process, consider the following points:

I. There are three (3) distinct areas within, which a fault may occur:

   1. External Interface.

      a. Circuitry external, but connecting to the SBD amplifier. (This area should have already been eliminated as a problem source.)

   2. Control Section

      a. SBD Drive Hybrid
      b. Modulation Hybrid
      c. Compensation Module
      d. Main Board

   3. Heat Sink

      a. Thermostat
      b. Power Transistor Modules

II. There are only two basic fault characteristics to be considered:

   - The motor exhibits very low torque or is totally inoperative.

   - The motor is erratic or exhibits an improper mode of operation.

III. Preparing the SBD amplifier for troubleshooting.

   - Please use caution when troubleshooting the SBD amplifier.

   - The recommended procedure for troubleshooting the unit is with the understanding that the Main Bus and Control Bus power supplies are functioning properly.

   - Disconnect the regeneration module (ACS-REG2 if installed) to eliminate it as a problem source.

- Remove all other SBD units from the rack assembly if installed to better access the defective unit.
- Do-not "cross" the connector wiring.

7.1 Motor Exhibits Very Low Torque or is Totally Inoperative

Prerequisites for motor movement under full torque mode are:

- Fault circuits must not be activated. Remove and reapply main power to clear internal fault circuits. The fault circuit logic information for the drive-up mode may be monitored at TP192. The SBD2 should be in the ENABLE mode when the following are at the voltage levels given with respect to TP192-1 (GND):

  TP192-2 -- +12 V
  TP192-3 -- LOW
  TP192-4 -- LOW
  TP192-6 -- HIGH

- The ± 12V DC Control Power must be present at Connector LS - -1 and 3 with respect to LS -2. Check fuses on SBD1-PS1 and SBD-PS2 Power Supply Cards.
- The Main Bus Power must be present at Connector C15-3 with respect to C15-1. Check fuse 17 on Main Board.
- The Green "Drive-Up" L.E.D. (5) must be illuminated (see Figure 3).
- The O.K. TO ENABLE output at Connector Output -1 and 3 must be LOW (Internal closure when the drive is up).
- The ENABLE input at Output -11 must be pulled LOW (Common).
- The ENABLED output at Connector Output -4 and 5 must be LOW. (Internal closure when the drive is up).
- The DIRECTION LIMIT inputs at Connector I/O -6 and 7 must be LOW to run (They are optional and must be HIGH to limit movement).

- The EXTERNAL LIMIT input at Connector I/O -10 must be HIGH (LOW to limit current).

- The TORQUE HOLD input at Connector I/O -12 must be HIGH (Open).

- The auxiliary contact within the motor overload relay should be closed (customer furnished).

- The continuity of the motor armature circuit must be maintained.

- Input signal must be present at Connector I/O -15 with respect to C14.

- If an ACS-REG regeneration module is used, the SBD amplifier "Over-Volts" circuit will shut the system down under heavy decelerations if the fuse on the ACS-REG module is blown. Check the fuse on the ACS-REG module. To test the Regeneration Module, press the REGEN TEST AND OVERVOLT RESET switch. Red L.E.D. should blink for proper operation.

7.2 Motor is Erratic or Exhibits an Improper Mode of Operation

Although improper operation may be brought about by any one of almost an infinite number of possible fault modes, the following troubleshooting hints will aid in locating some of the most probable faults:

1.	High Frequency oscillations exhibited by motor.	A.C. Gain Pot (29), located on Compensation Card, turned too far C.W. Adjust A.C. Gain Pot, per Section 5.7.
2.	Motor makes large oscillatory excursions or runs away.	Check motor and tach phasing, per Section 3.3. SBD system backwards in Position Loop (motor moves in wrong direction). Reverse both motor and tach leads. Excessive speed command signal present at input of SBD.

3.	Motor runs w/jerky motion.	Check tach feedback voltage with oscilloscope for interrupted signal. If tach signal has spikes going to zero, replace tach assembly.

7.3 Individual Circuit Testing (Refer to all Schematic Drawings and Figures)

Start the detailed testing procedure by first checking the power transistors.

Remove power. Remove the connections from the large power transistor modules. With a DVM in the diode test range check each power transistor section by placing the RED and BLACK probes of the meter on the designated points according to the following charts. Replace any defective power transistors.

SBD 1,6-Amp Amplifiers Only

B1 (Red) to C (Black) = LOW
B1 (Red) to E1 (Black) = LOW
B1 (Black) to C (Red) = HIGH
B1 (Black) to E1 (Red) = LOW
C (Black) to E1 (Red) = LOW
C (Red) to E1 (Black) = HIGH
B2 (Red) to CE (Black) = LOW
B2 (Red) to E2 (Black) = LOW
B2 (Black) to CE (Red) = HIGH
B2 (Black) to E2 (Red) = LOW
CE (Black) to E2 (Red) = LOW
CE (Red) to E2 (Red) = HIGH
C (Red) to E (Black) = HIGH
C (Black) to E (Red) = LOW

SBD 10,16 and 20

B1 (Red) to C1 (Black) = LOW
B1 (Red) to E1 (Black) = LOW
B1 (Black) to C1 (Red) = HIGH
B1 (Black) to E1 (Red) = LOW
C1 (Black) to E1 (Red) = LOW
C1 (Red) to E1 (Black) = HIGH
B2 (Red) to C2-E1 (Black) = LOW
B2 (Red) to E2 (Black) = LOW
B2 (Black) to C2-E1 (Red) = HIGH
B2 (Black) to E2 (Red) = LOW
C2-E1 (Black) to E2 (Red) = LOW
C2-E1 (Red) to E2 (Black) = HIGH

7.4 Testing the Control Circuits

Remove power and:

1. Remove all other SBD Boards from the rack assembly, if installed, to better access the defective SBD Board.

CAUTION: DO-NOT-INTERCHANGE-THE-CONNECTOR-WIRING.

2. Remove Connectors I/O, Output, C12, and C15 leaving only Connector LS (the $\pm$12 volt control supply).

3. Place a jumper between Connector I/O -12 and -1.
Place a jumper between TP45-5 and TP45-6 of the Main Board.
Place a jumper between TP192-3 and TP192-1 to defeat the Main Bus under voltage circuit.

7.4.1 Checking the Enable Circuits

O.K. TO ENABLE

Apply $\pm$12V DC control power. Using an ohmmeter, place the COMMON probe on Connector Output-1. Place the POSITIVE probe on Connector Output -3. The ohmmeter should read LOW on Opto-Coupler or Relay Option. (See Page 1 of D-81235).

Enable amplifier by adding a jumper from Connector I/O -11 to I/O -1. The reading of the ohmmeter should remain unchanged. The Green LED should become illuminated, indicating the SBD amplifier is enabled.

Remove the jumper from TP192-3 (under voltage protection circuit defeat). The ohmmeter should read HIGH. Replace jumper between TP192-3 and TP192-1.

ENABLED

Place COMMON probe of the ohmmeter on Connector Output-4 and POSITIVE probe on Output -5. The ohmmeter should read LOW. Disable the amplifier by removing the jumper between I/O -11 and I/O -1. The ohmmeter should read HIGH. Replace the jumper between I/O -11 and I/O -1.

Remove jumper from TP192-1. The ohmmeter should read HIGH. Replace jumper. The ohmmeter should read LOW.

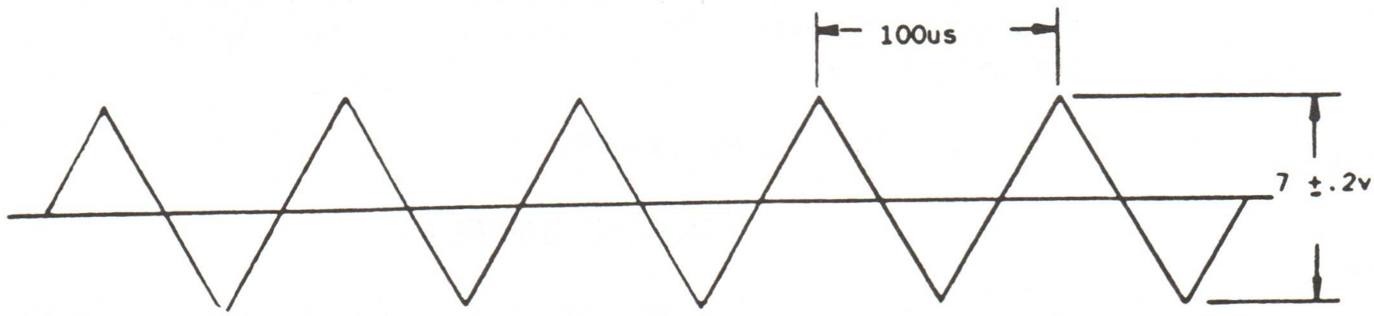
7.4.2 Checking the Triangle Wave Generator

With $\pm$12V DC applied, monitor TP159 (with respect to Common, Connector I/O -1) with an oscilloscope. The waveforms (for the 10khz standard SBD2) appear as follows:

NOTE: All SBD2 amplifiers operate at a 10khz switching frequency except:

1) The 1 amp continuous units which operate at 15khz.

2) The 105 units (Refer to Model Number System for SBD2 in front of Manual) which operate at 6.8khz.



10Khz$\pm$100hz

7.4.3 Checking the D.C. to D.C. Converter

To check the 16.9 kHz DC to DC Converter circuitry monitor the following points with a DC voltmeter:

For Section "A" - Negative end of Capacitor 116 with respect to its positive end for -6.5 $\pm$ 0.5V D.C.

Positive end of Capacitor 117 with respect to its negative end for +6.5 $\pm$ 0.5V DC.

For Section "C" - Positive end of Capacitor 118 with respect to its positive end for +6.5 ± 0.5V DC.

Negative end of capacitor 119 with respect to its positive end for -6.5 ± 0.5V DC.

7.4.4 Checking the Base Drive Circuits, the Modulation Hybrid, the Velocity Loop Circuit, and the SBD Hybrid

Remove ±12V DC power. Remove the jumper between Connector I/O -12 and 1. Remove the jumper between TP45-5 and 6 on the Main Board.

Add jumper from Connector I/O -11 to I/O -1 (if not installed) to enable the amplifier. Turn the Speed Scale Factor Pot (28) on the Compensation Card fully C.W.

Connect the Positive output of an adjustable D.C. signal source to Connector I/O -15 with respect to -14.

Temporarily connect a 33K resistor between TP45-7 and TP45-8. Also add a 120K resistor between TP45-5 and TP45-6.

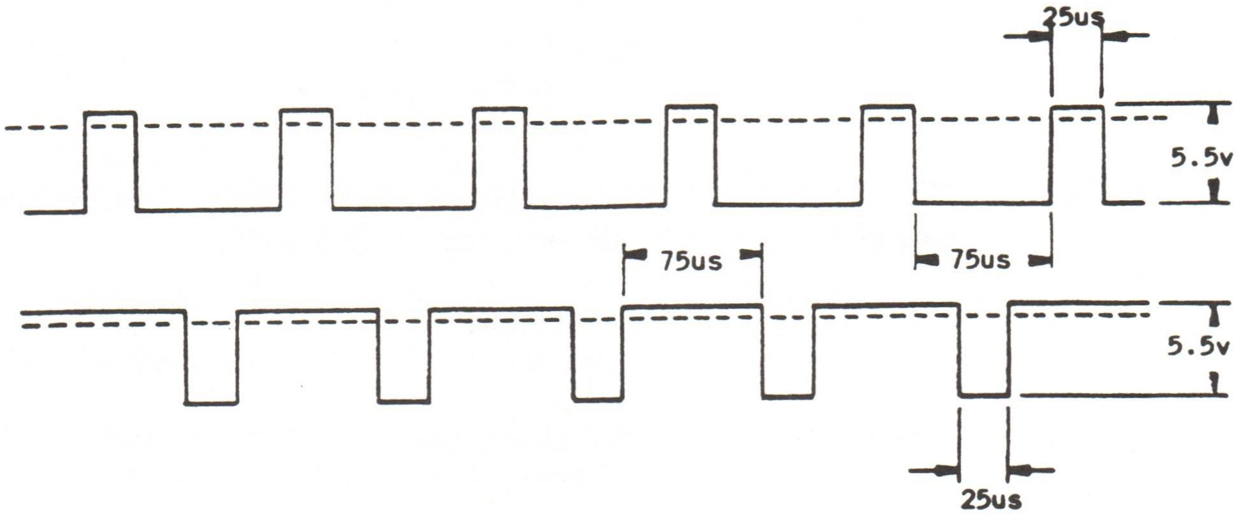
With zero input from the D.C. signal source monitor TP45-5 with a Digital Voltmeter. Adjust the zero offset pot (6) (located along the connector edge of the Main Board) for zero volts at TP45-5, ±0.5V DC.

BASE DRIVE CIRCUITS

With zero input from the adjustable signal source and using a dual-channel oscilloscope, monitor the anode of diode 74 (on the Main Board) with respect to the negative end of capacitor 117. Also monitor the anode of diode 124with channel 2, with respect to Connector I/O -1 (Common).

Apply ±12V DC. **DO NOT APPLY THE MAIN BUS SUPPLY OR SEVERE DAMAGE MAY OCCUR.**

With zero input from the D.C. signal source the Base Drive waveforms should appear similar to those below:



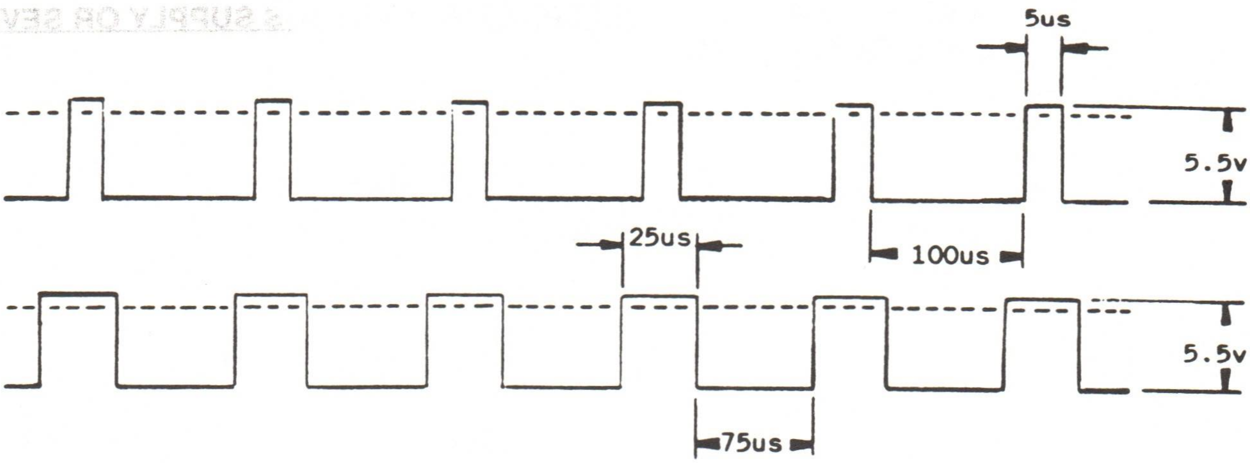
Apply a positive input signal to Connector I/O -15 with respect to -14. Gradually increase the input signal to approximately +5.0 volts. Both waveforms should gradually increase in pulse width until they become solid voltage levels at approximately -5.0 volts.

Apply a Negative input signal to Connector I/O -15 with respect to -14. Gradually increase the input signal to approximately -5.0 volts. Both waveforms should gradually increase in pulse width until they become solid voltage levels of approximately +1.2 volts.

Remove ±12V DC power. Apply zero input from the signal source. With channel 1 of the oscilloscope, monitor the anode of diode 65 with respect to the negative end of capacitor 118.

With channel 2, monitor the anode of diode 112 with respect to Connector I/O -1 (Common). Apply ±12V DC power.

The Base Drive waveforms should appear similar to those below:



Apply a Positive input signal to Connector I/O -15 with respect to -14. Gradually increase the input signal to approximately +5.0 volts. Both waveforms should gradually increase in pulse width until they become solid voltage levels of approximately +1.2 volts.

Apply a Negative input signal to Connector I/O -15 with respect to -14. Gradually increase the input signal to approximately -5.0 volts. Both waveforms should gradually increase in pulse width until they become solid voltage levels of approximately -5.0 volts.

Remove ±12V DC power.

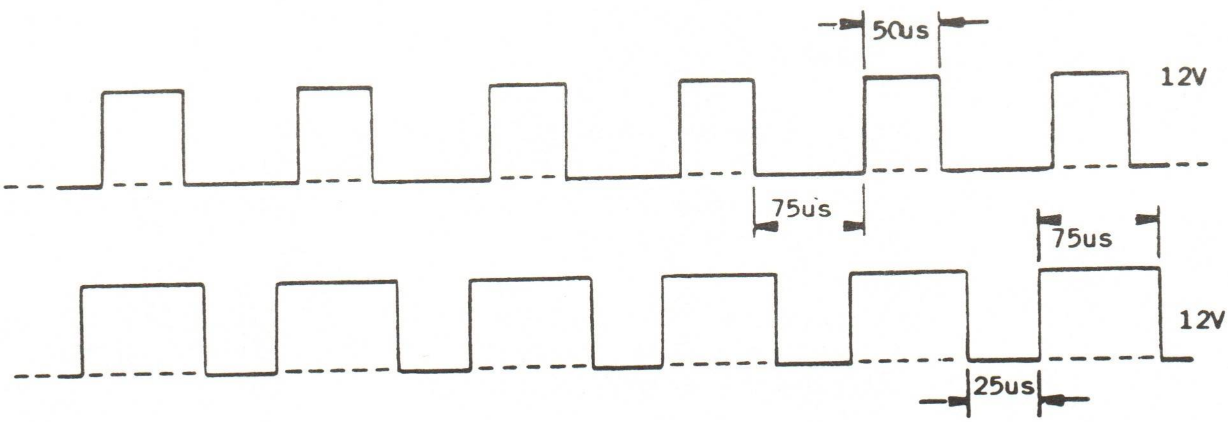
If testing the Base Drive circuits brought positive results, it is with high probability that these circuits (considered to be signal flow paths; commencing with the Base Drive circuits and proceeding to the Modulation Hybrid, the Velocity Loop circuit and the SBD Hybrid to the Input of the amplifier) are functioning properly.

If, on the other hand, the Base Drive tests were negative proceed to checking the remainder of the circuits under the headings of this section until the faulty circuit is located and the defective component localized.

MODULATION HYBRID

Remove ±12V DC power. Apply zero input from the signal source. With channel 1 of the oscilloscope monitor TP45-1. Monitor TP45-2 with channel 2, both are with respect to Connector I/O -1 (Common).

Apply ±12V DC power. These waveforms should appear similar to those below:

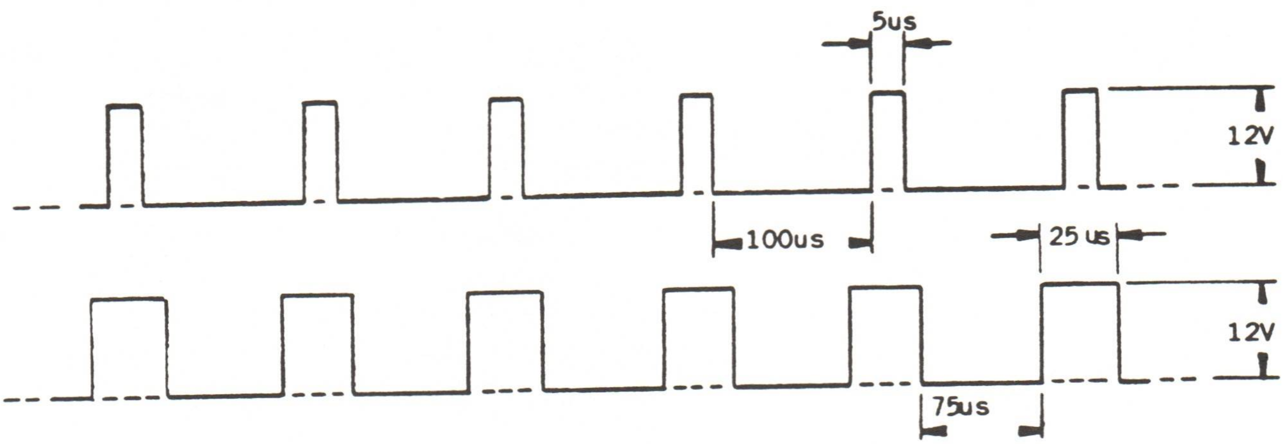


Apply a Positive input signal to Connector I/O -15 with respect to -14 (Common). Gradually increase the input signal to approximately +5.0 volts. Both waveforms should gradually increase in pulse width until they become solid at the zero voltage level.

Apply a Negative input signal to Connector I/O -15 with respect to -14 (Common). Gradually increase the input signal to approximately -5.0 volts. Both waveforms should gradually increase in pulse width until they become solid voltage levels of approximately +12.0 volts.

Remove ±12V DC power. Apply zero input from the signal source. With channel 1 of the oscilloscope, monitor TP45- 3. Monitor TP45-4 with channel 2, both are with respect to Connector I/O -1 (Common).

Apply ±12V DC power. These waveforms should appear similar to those below:



Apply a Positive input signal to I/O -15 with respect to -14. Gradually increase the input signal to approximately +5.0 volts. Both waveforms should gradually increase in pulse width until they become solid voltage levels of approximately +12.0 volts.

Apply a Negative input to I/O -15 with respect to -14. Gradually increase the input signal to approximately -5.0 volts. Both waveforms should gradually increase in pulse width until they become solid at the zero voltage level. Remove ±12V DC power.

If the outputs of the Modulation Hybrid brought positive results, it is very likely the Base Drive circuitry is faulty. Troubleshoot the Base Drive section to localize the defective component.

If the outputs from the Modulation Hybrid brought negative results, proceed checking the remainder of the circuits under the headings of this section until the faulty circuit is located.

SBD HYBRID (SECOND SECTION):

Monitor TP45-5. Apply ±12V DC power. Gradually increase the input signal to approximately +10.0 volts. The output of the SBD Hybrid should follow the input and clamp at about -8.0 volts.

Reverse the polarity of the input signal. The output at TP45-5 should clamp at approximately +8.0 volts. Remove ±12V DC power.

If the outputs of the SBD Hybrid, at TP45-5, brought positive results, it is very likely the Modulation Hybrid is defective. Replace the Modulation Hybrid.

If the outputs of the SBD Hybrid brought negative results, proceed checking the circuits under the headings of this section.

VELOCITY LOOP CIRCUIT

Monitor TP45-8. Apply ±12V DC power. Gradually increase the input signal to approximately +10.0 volts. The output of the Velocity Loop Op-Amp at TP45-8 should follow the input and reach an amplitude of approximately +11.0 volts.

Reverse the polarity of the input signal. The output at TP45-8 should go to approximately -11.0 volts. Remove ±12V DC power.

If the output of the Velocity Loop Op-Amp, at TP45-8, brought positive results it is likely the SBD Hybrid is defective. Replace the SBD Hybrid.

If the output at TP45-8 brought negative results, proceed to the next circuit.

SBD HYBRID (FIRST SECTION):

Monitor Pin 7 of the SBD Hybrid. Apply ±12V DC power. Gradually increase the input signal to approximately +10.0 volts. The output at Pin 7 should follow the input and reach an amplitude of approximately -9.5 volts. Reverse the polarity of the input signal. The output at Pin 7 should go to approximately +9.5 volts. If the output at Pin 7 brought negative results, replace the SBD Hybrid. Remove ±12V DC power. This concludes the circuit tests.

8.0 SPARE PARTS LIST

DESCRIPTION	PART NUMBER
SBD Hybrid	A-79952
SBD Modulation	A-79563
Power Transistor (6 Amp Units)	A-80120
Power Transistor (10 Amp Units)	A-80122
Power Transistor (16 Amp Units)	A-80121
Power Transistor (20 Amp Units)	A-79957
Fuse (F17) (Main Board) (6 Amp Units)	A-78900-014 (10A)
Fuse (F17) (Main Board) (10 Amp Units)	A-78900-015 (15A)
Fuse (F17) (Main Board) (16 Amp Units)	A-78900-016 (20A)
Fuse (F17) (Main Board) (20 Amp Units)	A-80552-005 (25A)
Thermostat	A-29616
Fuse for $\pm$12V DC Power Supply	A-79787-001
SBDI-PSI	$\pm$12V DC Power Supply Card
SBD -PS2	$\pm$12V DC Power Supply Card
ACS-REG2-160	Regeneration Card for 160 Volt Bus
ACS-REG2-225	Regeneration Card for 225 Volt Bus

APPENDIX A

1.0 SBD CONNECTOR INFORMATION

Mating connectors are customer furnished items which may be obtained either from I.D. or purchased directly from connector vendors.

The specifications for the connector components are given below:

1.1 Basic Connectors

I.D. Drawing Number

CONNECTOR	DESCRIPTION	DRAWING NUMBER
I/O	Housing	A-81584-016
Output	Housing	A-81584-005
LS	Housing	A-81584-004
I/O, Output, LS	Terminal	A-81585
I/O (position 9)	Polarizing Key	A-82779
Output (position 2)	Polarizing Key	A-82779
C12 (when used)	Housing	A-80838-003
C15	Housing	A-80363-003
C12, C15	Terminal	A-80361*
C12	Clamp	A-80856-001
C15	Clamp	A-80856-002

Connector Kits For SBD Drive Boards

One Connector Kit is required for each SBD drive board.

1.2 Connector Kit and Cabling Model Number Systems

For SBD2 <u>With</u> SBPR1-25 and 48 Power Supply

Example: SBC2-00X

SBC2 - . . . . Connectors I/O, Output, LS,C12,C15
X -. . . . . Length of leads (1 to 7 meters)

Example: SBC2-000 (no leads) Basic Parts Package*
SBC2-001 With 1 meter length leads

For SBD2 <u>With</u> Frame Assembly

Example: SBD2-10X

SBC2 - . . . . Connectors I/O, Output, C12
X - . . . . Length of leads (1 to 7 meters)

Example: SBC2-100 (No leads) Basic Parts Package*
SBC2-101 With 1 meter length leads

For SBD2 <u>With</u> SBPR1-15 Power Supply

Example: SBD-20X

SBC2 - . . . . Connectors I/O, Output, LS, C12, C15
X - . . . . Length of Leads (1 to 7 meters)

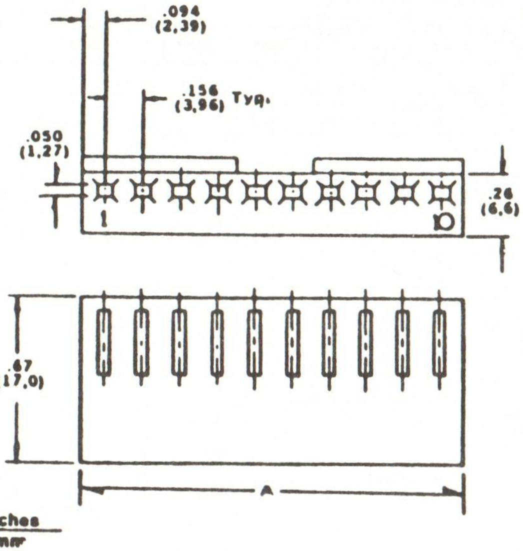
Example: SBC2-200 (No leads) Basic Parts Package*
SBC2-201 With 1 meter length leads

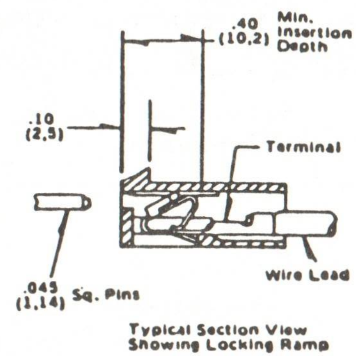
*To insure reliable connections, the proper crimping tool must be used when connecting wires to Amp Power Lock contact 53892-4 (INDUSTRIAL DRIVES PART NO. A-68347-1). The crimping tool recommended is Amp 30 series connector tool number 68347-1. The tool may be ordered from Amp, Inc., Harrisonburg, Pennsylvania 17105.

DWG. NO. A-81584 ISSUE 1

NOTES:

1. DASH NO. INDICATES NO. OF CIRCUITS (2 – 24 CIRCUITS).
2. FOR USE WITH A-81585 TERMINAL.
3. ACCEPTS .045" SQ. PINS ON .156" CTRS.
4. HOUSING TO HAVE LOCKING RAMP.





APPROVED VENDOR: MOLEX

DASH NO.	PART NO.	DIM. A	DASH NO.	PART NO.	DIM. A	DASH NO.	PART NO.	DIM. A
002	26-03-4020	.344±.007	010	26-03-4101	1.592±.012	018	26-03-4181	2.840±.016
003	26-03-4030	.500±.007	011	26-03-4111	1.748±.012	019	26-03-4191	2.996±.016
004	26-03-4041	.656±.007	012	26-03-4121	1.904±.012	020	26-03-4201	3.152±.020
005	26-03-4050	.812±.007	013	26-03-4131	2.060±.014	021	26-03-4211	3.308±.020
006	26-03-4061	.968±.007	014	26-03-4141	2.216±.016	022	26-03-4221	3.464±.020
007	26-03-4070	1.124±.007	015	26-03-4151	2.372±.016	023	26-03-4231	3.620±.020
008	26-03-4081	1.280±.012	016	26-03-4161	2.528±.016	024	26-03-4241	3.776±.020
009	26-03-4090	1.436±.012	017	26-03-4171	2.684±.016			

KOLLMORGEN CORPORATION — INDUSTRIAL DRIVES DIVISION, RADFORD, VIRGINIA

UNLESS OTHERWISE SPECIFIED
XX DEC. PLACES ±.015
XXX DEC. PLACES ±.005
ANG. DIM. ±1°

DO NOT SCALE DWG. USE DIMENSIONS ONLY
ALL DIMENSIONS ARE INCHES
UNLESS OTHERWISE SPECIFIED

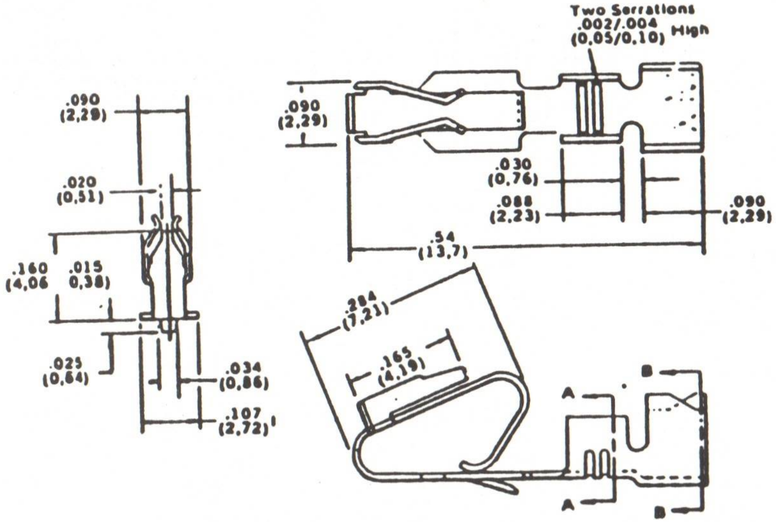
NO.	ECN NO.	DATE	APP'D.	NO.	ECN NO.	DATE	APP'D.

DW'N BY: TIM G. DATE: 8·23·85
CH'K BY:
APP'D BY: SCM 4-17-86

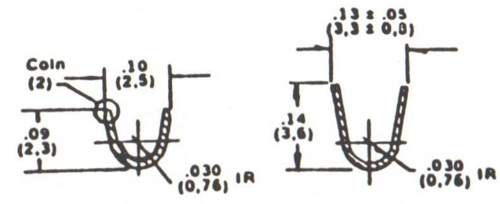
PURCHASE SPEC.
.156 CTR. CRIMP TERM. HOUSING
FOR TRIFURCON TERMINALS

SCALE: DWG. NO. A-81584 ISSUE 1

DWG. NO **A-81585** ISSUE 2

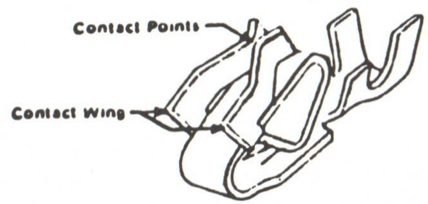


Crimp Dimensions



Section A-A

Section B-B



TRIFURCON TERMINAL

NOTES:

1. WIRE SIZE AWG 18-24.
2. INSULATION O.D. .110", (2.79MM) MAX.
3. FOR USE WITH A-81584 HOUSING.
4. TIN PLATED
5. DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS.

APPROVED VENDOR: MOLEX PART NO. 08-50-0189 LOOSE

E COPY CODE

KOLLMORGEN CORPORATION — INDUSTRIAL DRIVES DIVISION, RADFORD, VIRGINIA

UNLESS OTHERWISE SPECIFIED
XX DEC. PLACES ± .015
XXX DEC. PLACES ± .005
ANG. DIM. ± 1°

DO NOT SCALE DWG. USE DIMENSIONS ONLY
ALL DIMENSIONS ARE INCHES
UNLESS OTHERWISE SPECIFIED

NO.	ECN NO.	DATE	APP'D.	NO.	ECN NO.	DATE	APP'D.
				2	83442 MHE	5	

DW'N BY: TIM G. DATE: 8-26-85
CH'K BY:
APP'D BY:

PURCHASE SPEC. FOR CRIMP TERM. HOUSING FOR TRIFURCON TERM. (.156 CENTERS)

SCALE: | DWG. NO. **A-81585** | ISSUE 2

DWG NO	ISSUE
A- 82779	1

NOTE: SEE DWG. NO. A-81584 FOR CRIMP TERMINAL HOUSING.

APPROVED VENDOR: MOLEX (89-00-3001)

UNLESS OTHERWISE SPECIFIED XX DEC. PLACES ± .015 XXX DEC. PLACES ± .005 ANG. DIM. ±1°	NO.	ECN NO.	DATE	APP'D.	NO.	ECN NO.	DATE	APP'D.	DW'N BY LLS	DATE 7-16-87
									CH'K BY	
DO NOT SCALE DWG USE DIMENSIONS ONLY ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE SPECIFIED									APP'D BY FCM	7-17-8

KOLLMORGEN CORPORATION · 'DUSTRIAL DRIVES DIVISION
RADFORD, VIRGINIA

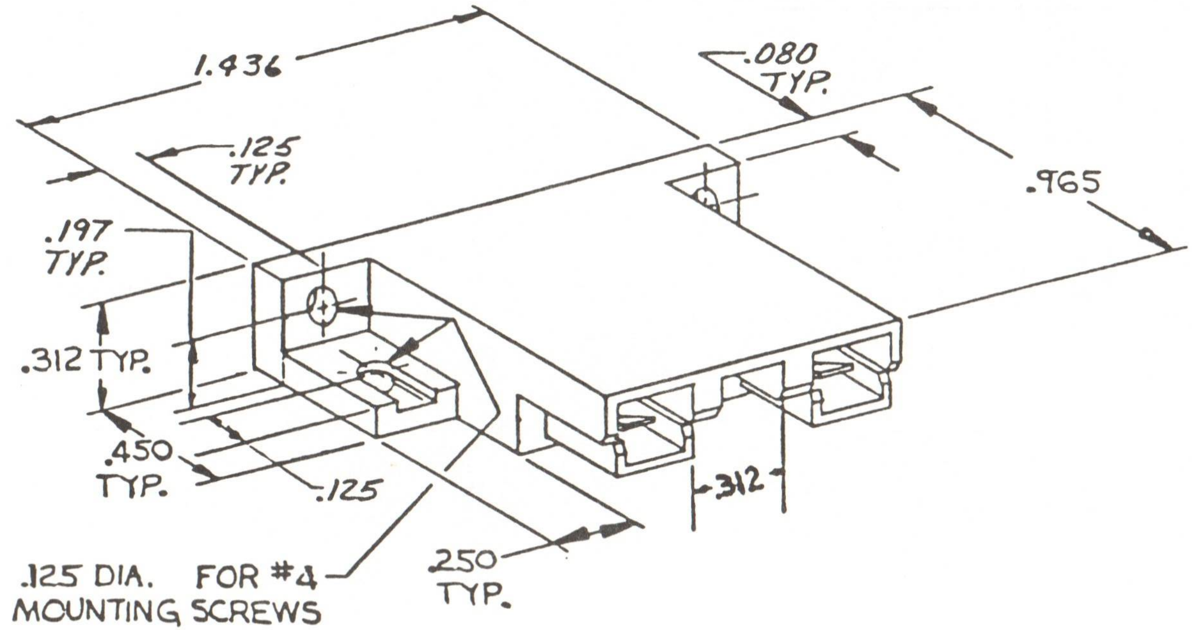
'URCHASE SPEC.
POLARIZING KEY

SCALE:	DWG NO	ISSUE
	A- 82779	1

DWG NO A-80838 ISSUE 3

NOTES:

1) MATERIAL: NYLON
2) COLOR: RED
3) MATES WITH A-80839.
4) ACCEPTS CONTACTS A-80361.
5) CENTER TO BE OPEN.
6) THREE POSITION.



APPROVED VENDOR: AMP # 55528-1 2 3

E COPY CODE

KOLLMORGEN CORPORATION — INDUSTRIAL DRIVES DIVISION, RADFORD, VIRGINIA

UNLESS OTHERWISE SPECIFIED
XX DEC. PLACES ± .015
XXX DEC. PLACES ± .005
ANG. DIM ± 1°

DO NOT SCALE DWG. USE DIMENSIONS ONLY
ALL DIMENSIONS ARE INCHES
UNLESS OTHERWISE SPECIFIED

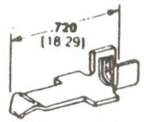
NO	ECN NO	DATE	APP'D	NO	ECN NO	DATE	APP'D
				3	82871 OWENS	12/29/[illegible]	cm

DW'N BY	DATE
CS	6/8/85
CH'K BY	
[illegible]	7/27/85
APP'D BY	
ccm	9-1-85

PURCHASE SPEC.
POWER LOCK, 30 SERIES,
W/FEMALE KEY

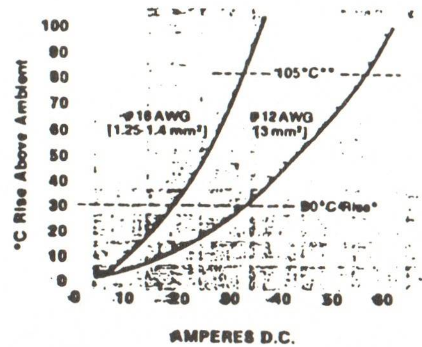
SCALE 1X — DWG NO A-80838 — ISSUE 3

DWG NO	ISSUE
A-80361	2



VENDOR: AMP 53892-3-STRIP
AMP 53892-5-LOOSE
MAT: .035 COPPER
WIRE RANGE: 12 MAX.
PLATING: SILVER

Test Parameters
Housing Assembly No. 53894.
Plated Contact No. 53892.
No. 12 AWG [3 mm²] and No. 16 AWG [1.25–1.4 mm²] common wire.
Tested as single in-line connectors.



INDUSTRIAL DRIVES
Radford, Virginia
A KOLLMORGEN DIVISION

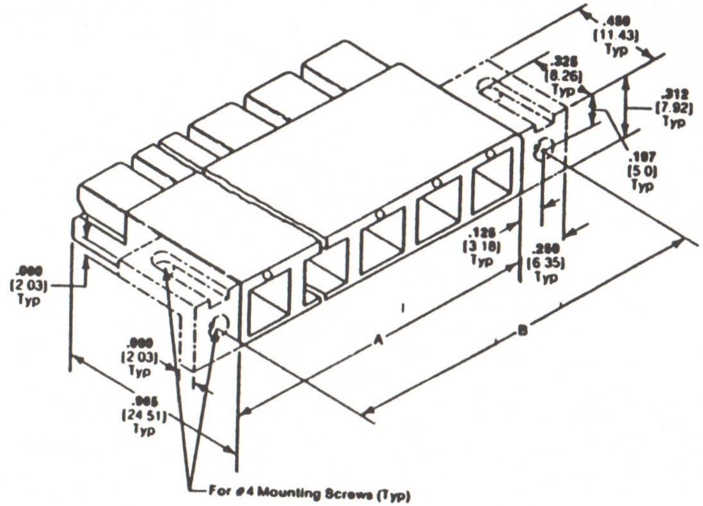
UNLESS OTHERWISE SPECIFIED XX DEC. PLACES ± .015 XXX DEC. PLACES ± .005 ANG. DIM. ±1°	NO.	ECN NO.	DATE	APP'D.	NO.	ECN NO.	DATE	APP'D.	DW'N BY	DATE	PURCHASE SPEC SOLDER CONTACT
					2	82189 OWENS	6/11/87	SCM	LLS	10/17/83	
DO NOT SCALE DWG. USE DIMENSIONS ONLY ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE SPECIFIED									CH'K BY		
									APP'D BY SCM	10/21/83	SCALE: DWG. NO. A-80361 ISSUE 2

DWG. NO **A-80363** ISSUE 1

MAT: NYLON NATURAL COLOR

VENDOR: AMP

TEMP LIMIT: 105° C

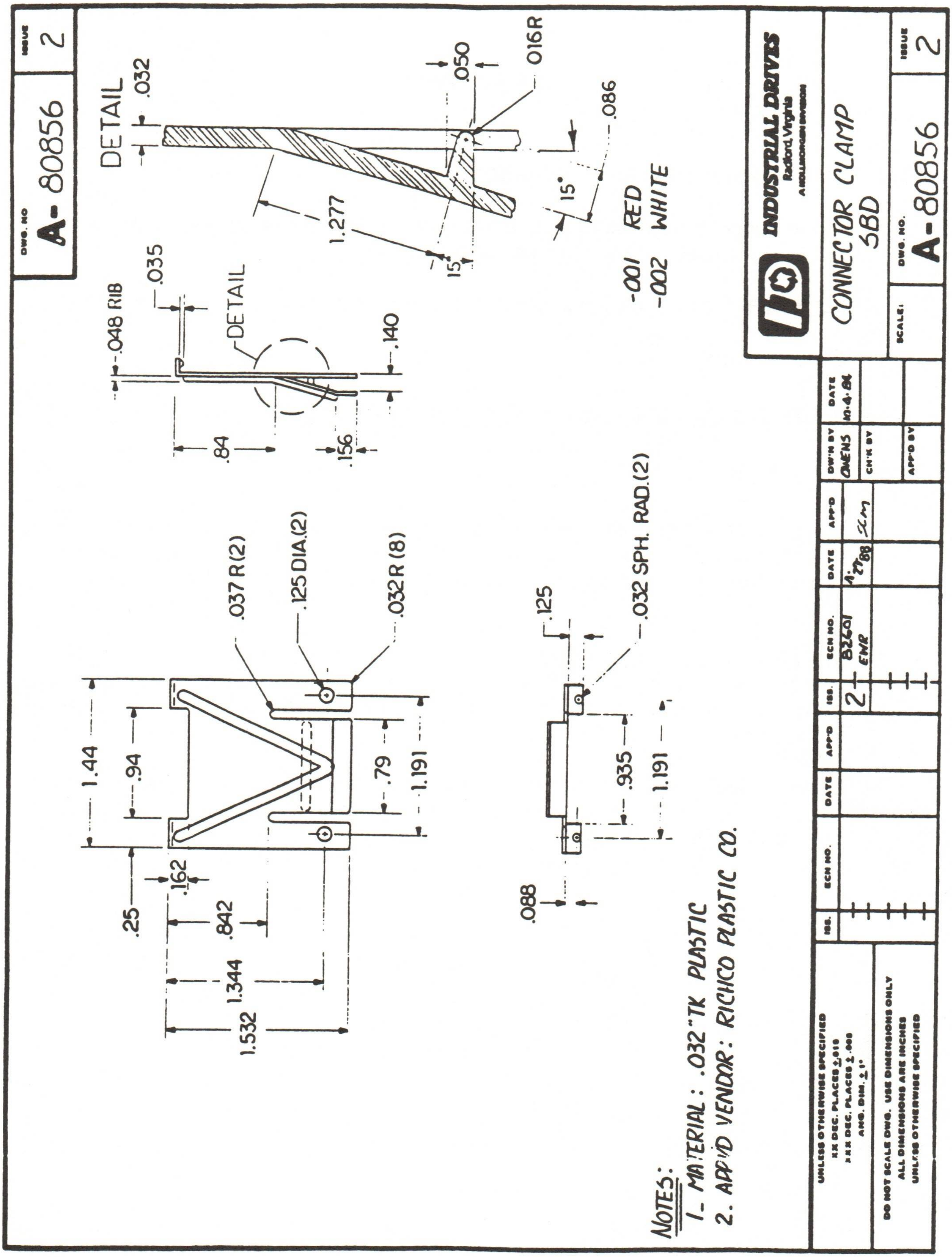


	No. of Positions	Dimensions A	Dimensions B*	Part Numbers With Flanges
A-80363-001	1	.312 7.92	.562 14.27	54489-1
A-80363-002	2	.624 15.85	.874 22.2	54489-2
A-80363-003	3	.936 23.77	1.186 30.12	54489-3
A-80363-004	4	1.248 31.7	1.498 38.05	54489-4
A-80363-005	5	1.560 39.62	1.810 45.97	54489-5
A-80363-006	6	1.872 47.55	2.122 53.9	54489-6

*Dimension required only for housing with mounting figures.

KOLLMORGEN CORPORATION — INDUSTRIAL DRIVES DIVISION, RADFORD, VIRGINIA

UNLESS OTHERWISE SPECIFIED XX DEC. PLACES ± .015 XXX DEC. PLACES ± .005 ANG. DIM. ±1° DO NOT SCALE DWG. USE DIMENSIONS ONLY ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE SPECIFIED	NO.	ECN NO.	DATE	APP'D.	NO.	ECN NO.	DATE	APP'D.	DW'N BY LLS	DATE 10/17/83	PURCHASE SPEC. IN LINE HOUSING W/ FLANGE
									CH'K BY		
									APP'D BY SCM	10/19/83	SCALE: ~ DWG. NO. A-80363 ISSUE 1


DWG. NO
A- 80856
ISSUE
2
DETAIL
.032
.050
.016R
.086
1.277
15°
.15
-001 RED
-002 WHITE
.048 RIB
.035
DETAIL
.140
.84
.156
.037 R (2)
.125 DIA.(2)
.032 R (8)
1.44
.94
.79
1.191
.25
.162
.842
1.344
1.532
.125
.032 SPH. RAD.(2)
.935
1.191
.088
NOTES:
1. MATERIAL : .032" TK PLASTIC
2. APP'D VENDOR : RICHCO PLASTIC CO.
INDUSTRIAL DRIVES
Radford, Virginia
A KOLLMORGEN DIVISION
CONNECTOR CLAMP
5BD
SCALE:
DWG. NO.
A- 80856
ISSUE
2
DW'N BY OWENS
DATE 10-4-84
CH'K BY
APP'D BY
ISS. 2
ECN NO. B2601 EWR
UNLESS OTHERWISE SPECIFIED
XX DEC. PLACES ±.010
XXX DEC. PLACES ±.005
ANG. DIM. ±1°
DO NOT SCALE DWG. USE DIMENSIONS ONLY
ALL DIMENSIONS ARE INCHES
UNLESS OTHERWISE SPECIFIED

APPENDIX B

1.0 SBD Power Supply Information

Power supplies are customer furnished items which may be obtained either from I.D. or purchased directly from power supply vendors.

Some specifications for the power supplies are given below:

1.1 Control Bus

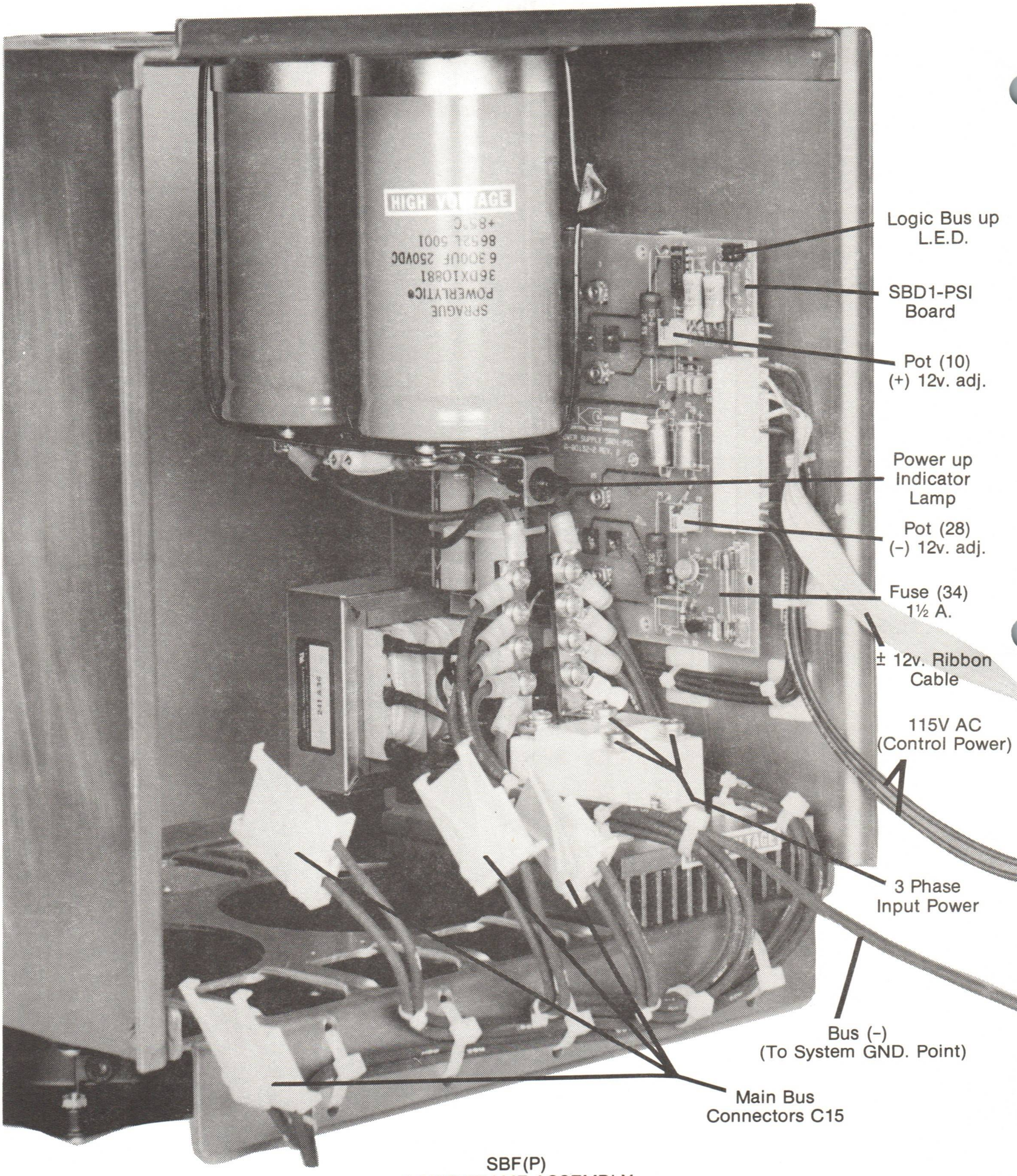
±12V DC @ 0.2% regulation; ±400 ma. per SBD unit.

1.2 Main Bus

The SBD2-XX-1XXX series amplifiers operate from a normal bus of 75 to 160V DC. The "Under-volts" circuit will trip at approximately 60V DC and shut the system down. The "Over-volts" circuit will trip at approximately 215V DC and shut the system down.

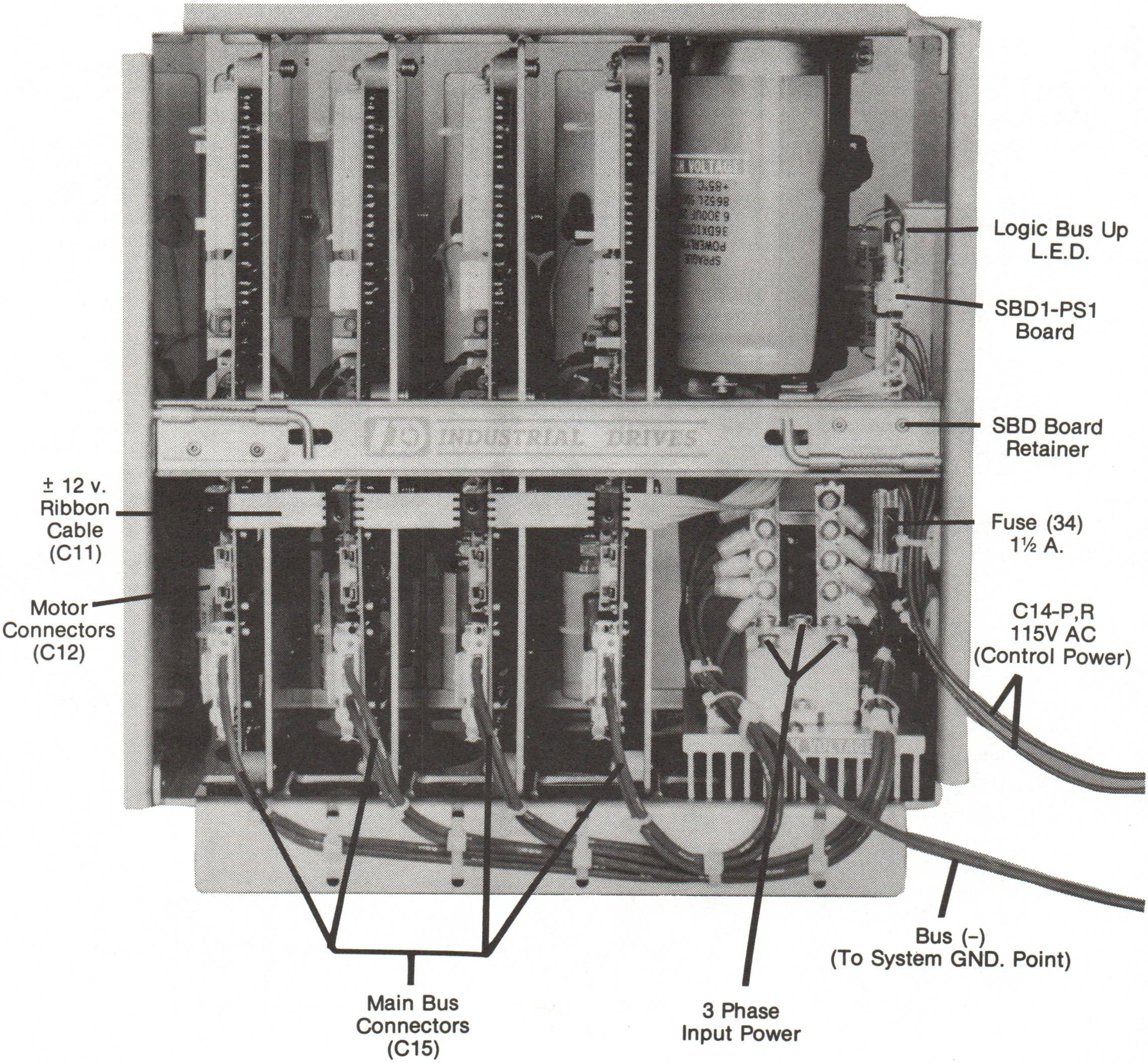
The SBD2-XX-2XX series amplifiers operate from a normal bus of 110 to 225V DC. The "Under-volts" circuit will trip at approximately 100 DC and shut the system down. The "Over-volts" circuit will trip at approximately 300V DC and shut the system down.

Other critical specifications on the Main Bus Power Supply are application dependent and should be discussed, according to application with our application engineering department.



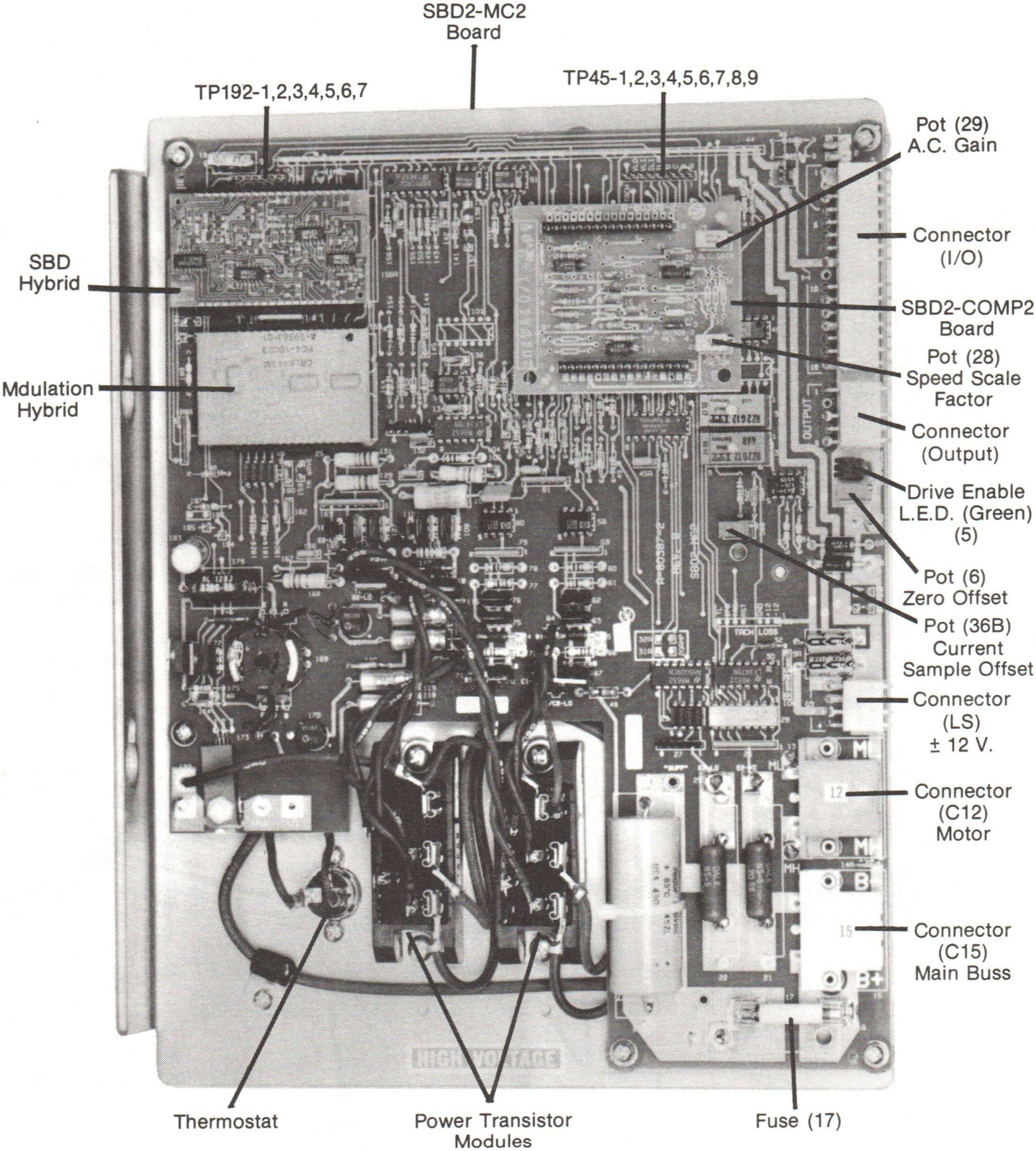
SBF(P)
4 AXIS FRAME ASSEMBLY

FIGURE 1



SBF(P)
4 AXIS FRAME ASSEMBLY
WITH SBD2 AMPLIFIERS

FIGURE 2



SBD2
MOTOR CONTROL MODULE
(DRIVE AMPLIFIER)

FIGURE 3

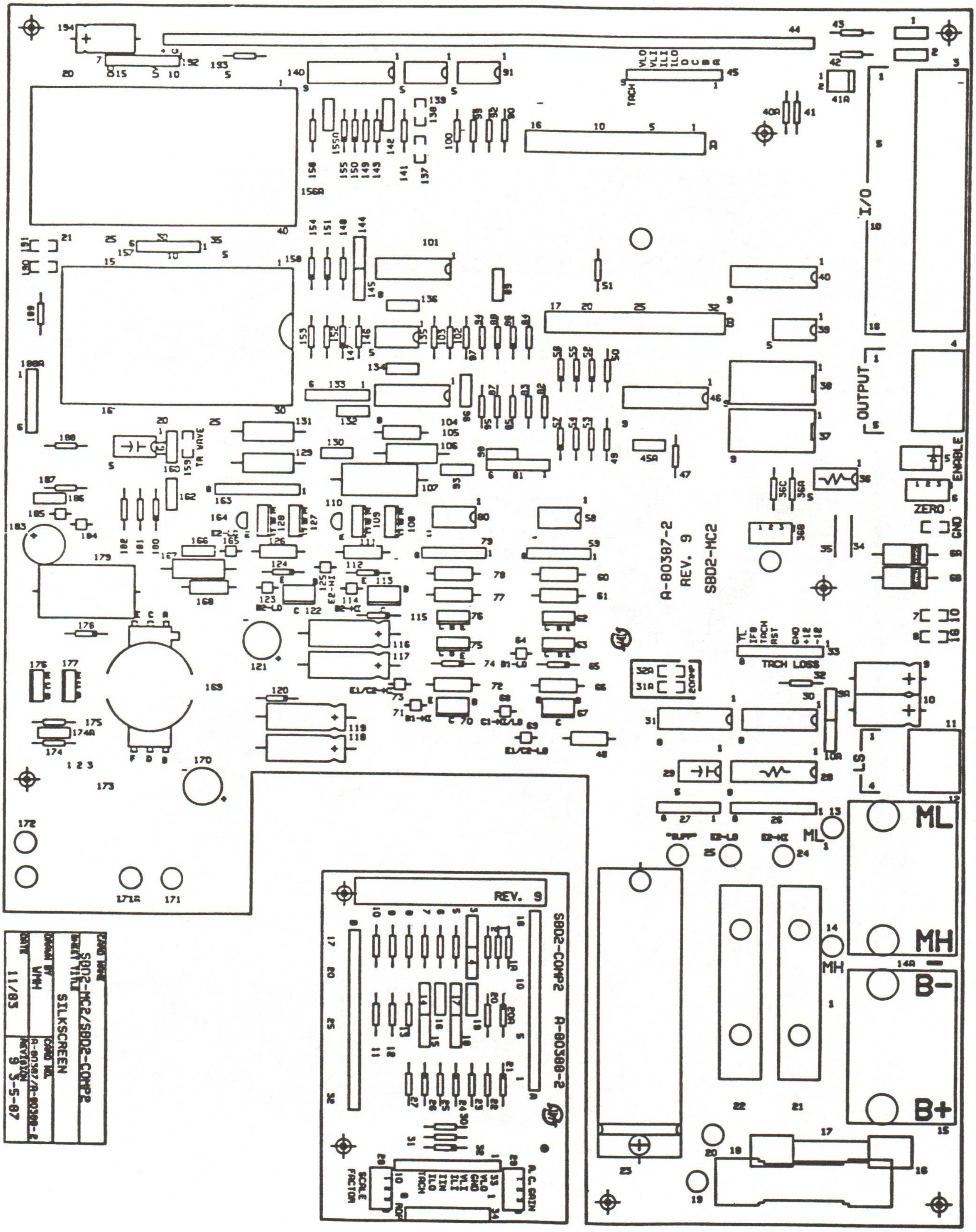
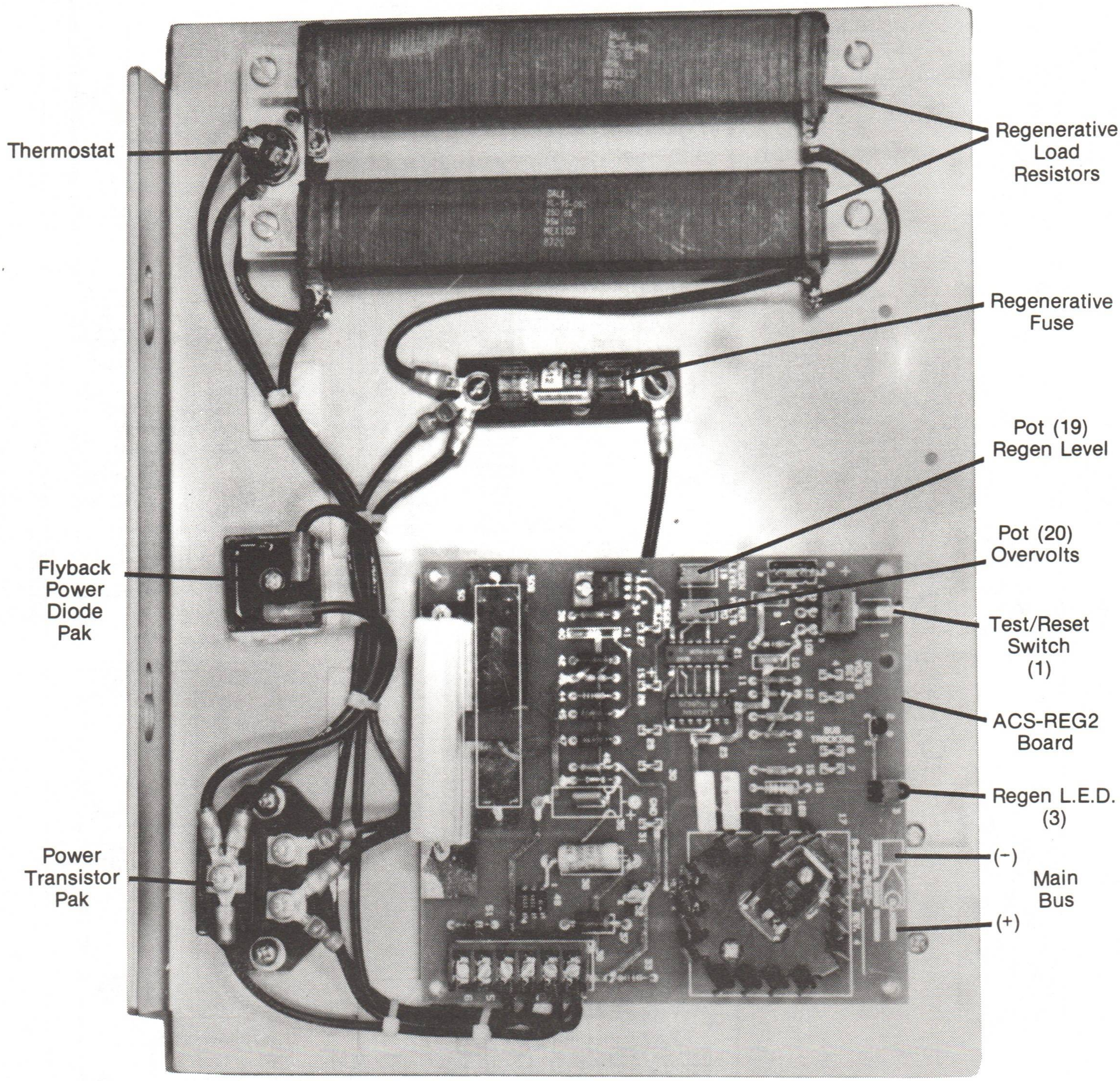
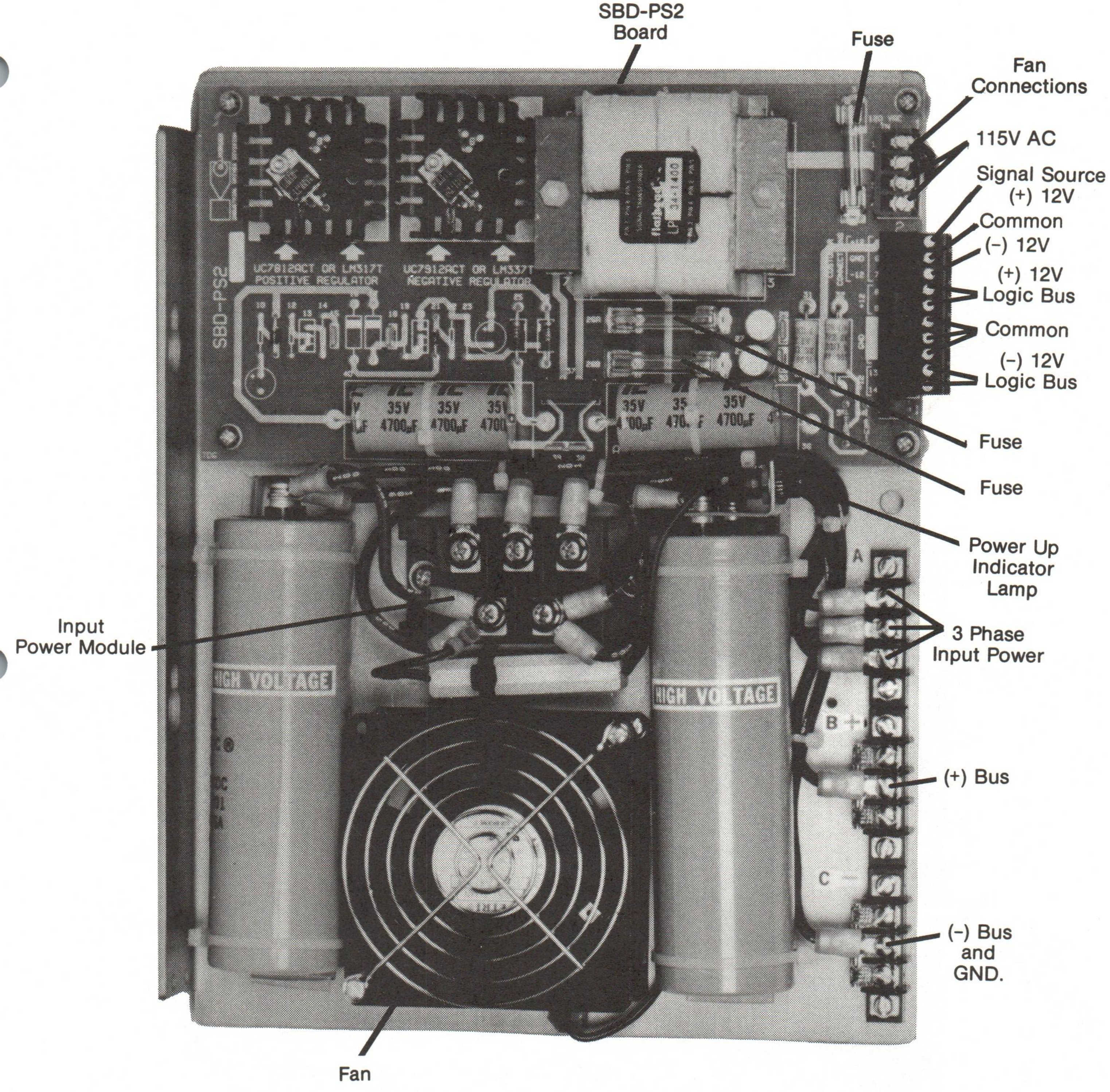


FIGURE 4
SBD2-MC2/SBD2-COMP2



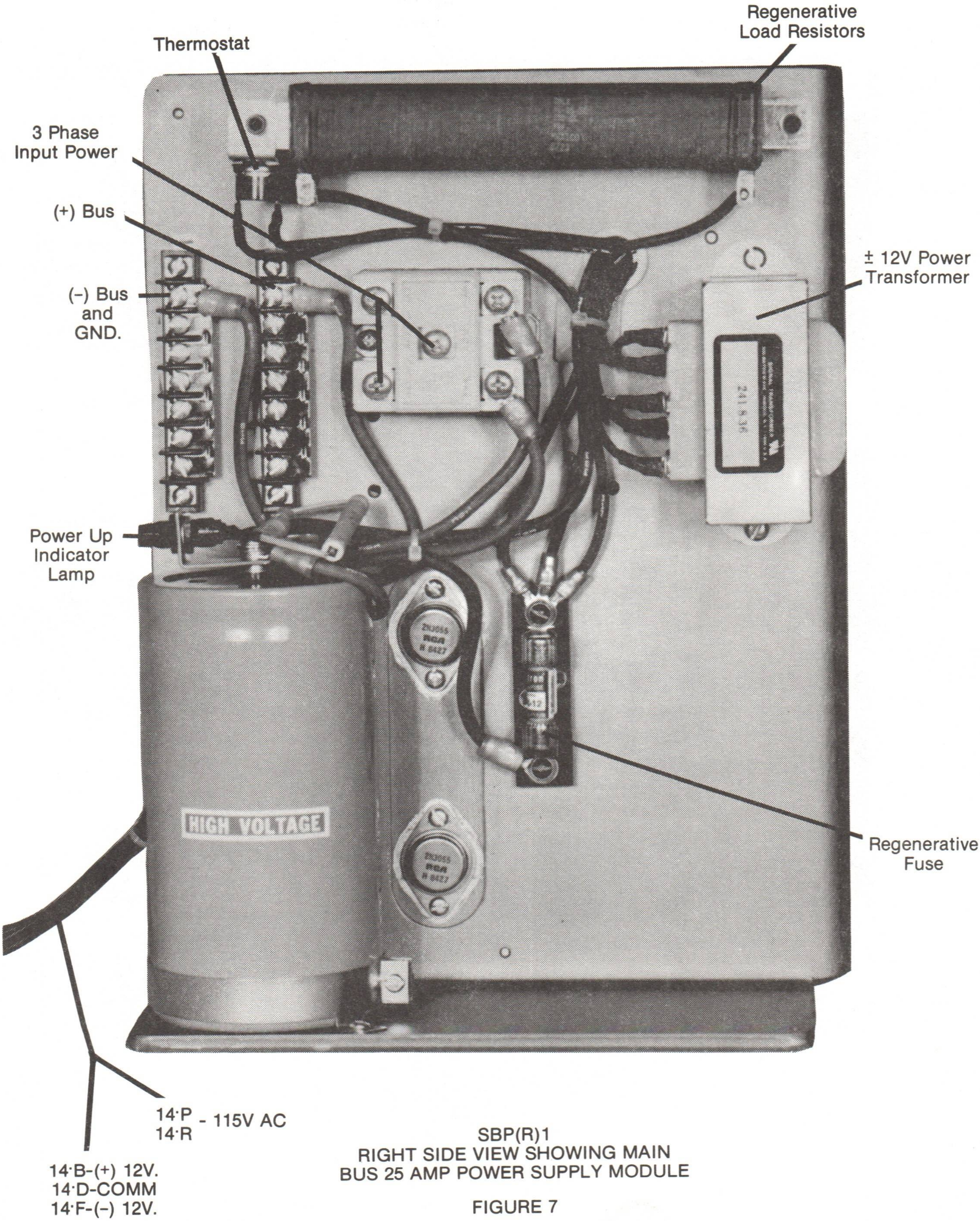
SBR1
REGENERATION MODULE

FIGURE 5



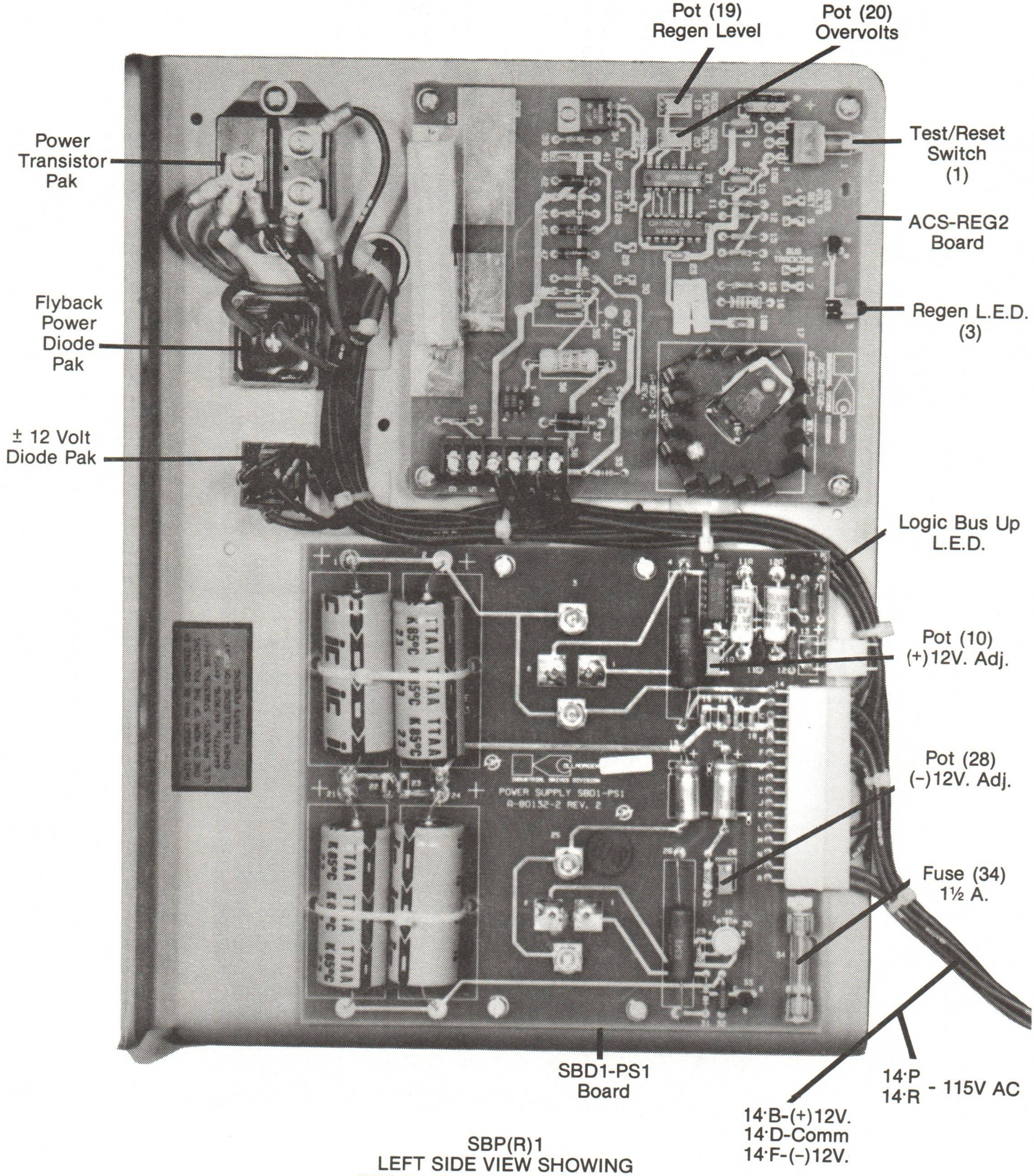
SBP(R)1
15 AMP POWER SUPPLY MODULE

FIGURE 6



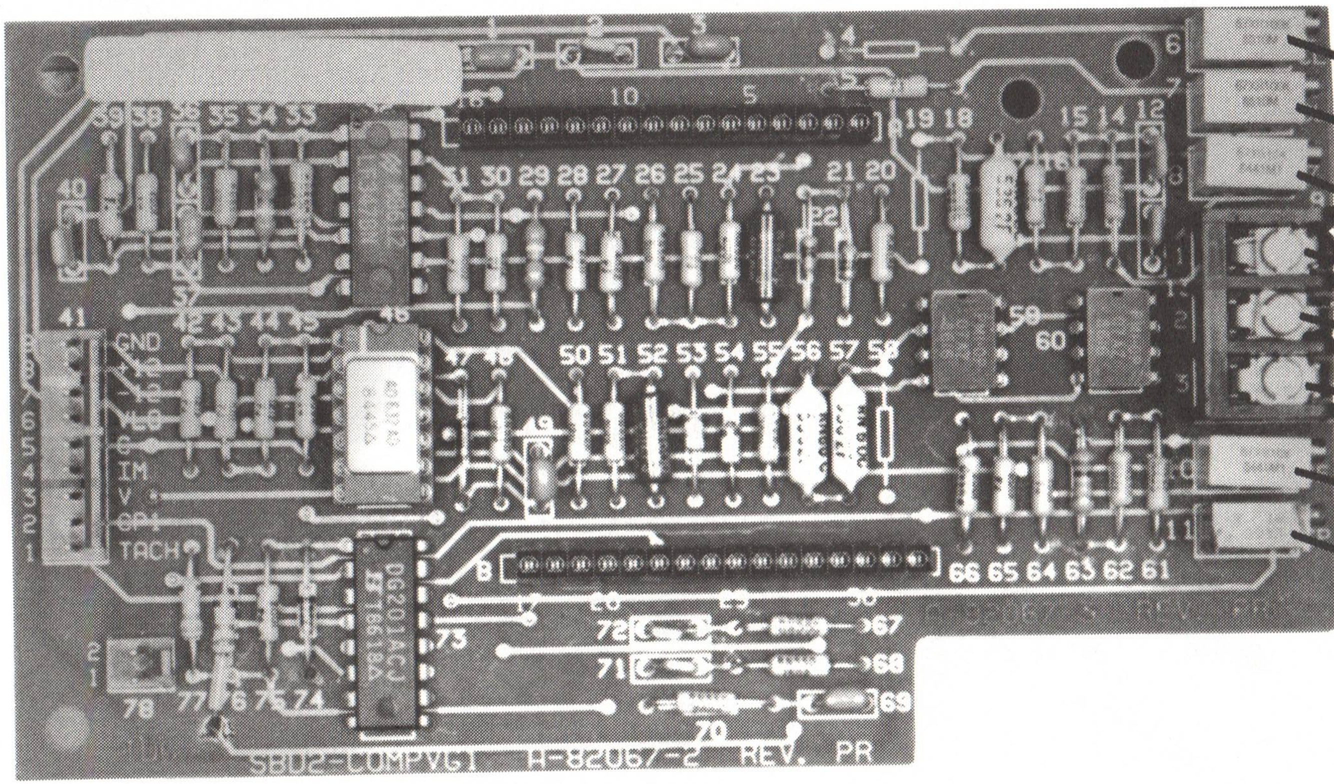
SBP(R)1
RIGHT SIDE VIEW SHOWING MAIN
BUS 25 AMP POWER SUPPLY MODULE

FIGURE 7



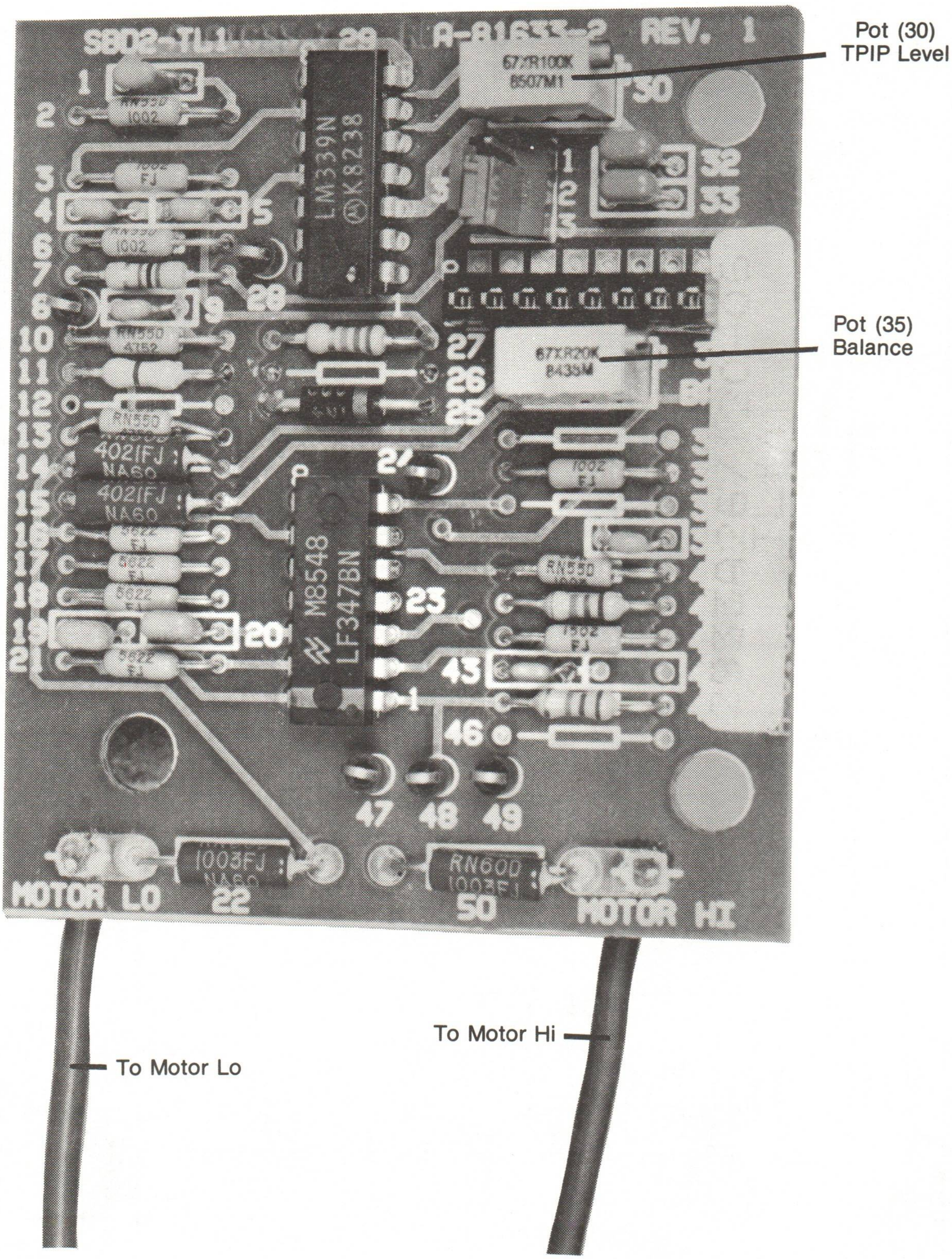
SBP(R)1
LEFT SIDE VIEW SHOWING
REGENERATION MODULE AND
± 12 VOLT CONTROL SUPPLY

FIGURE 8



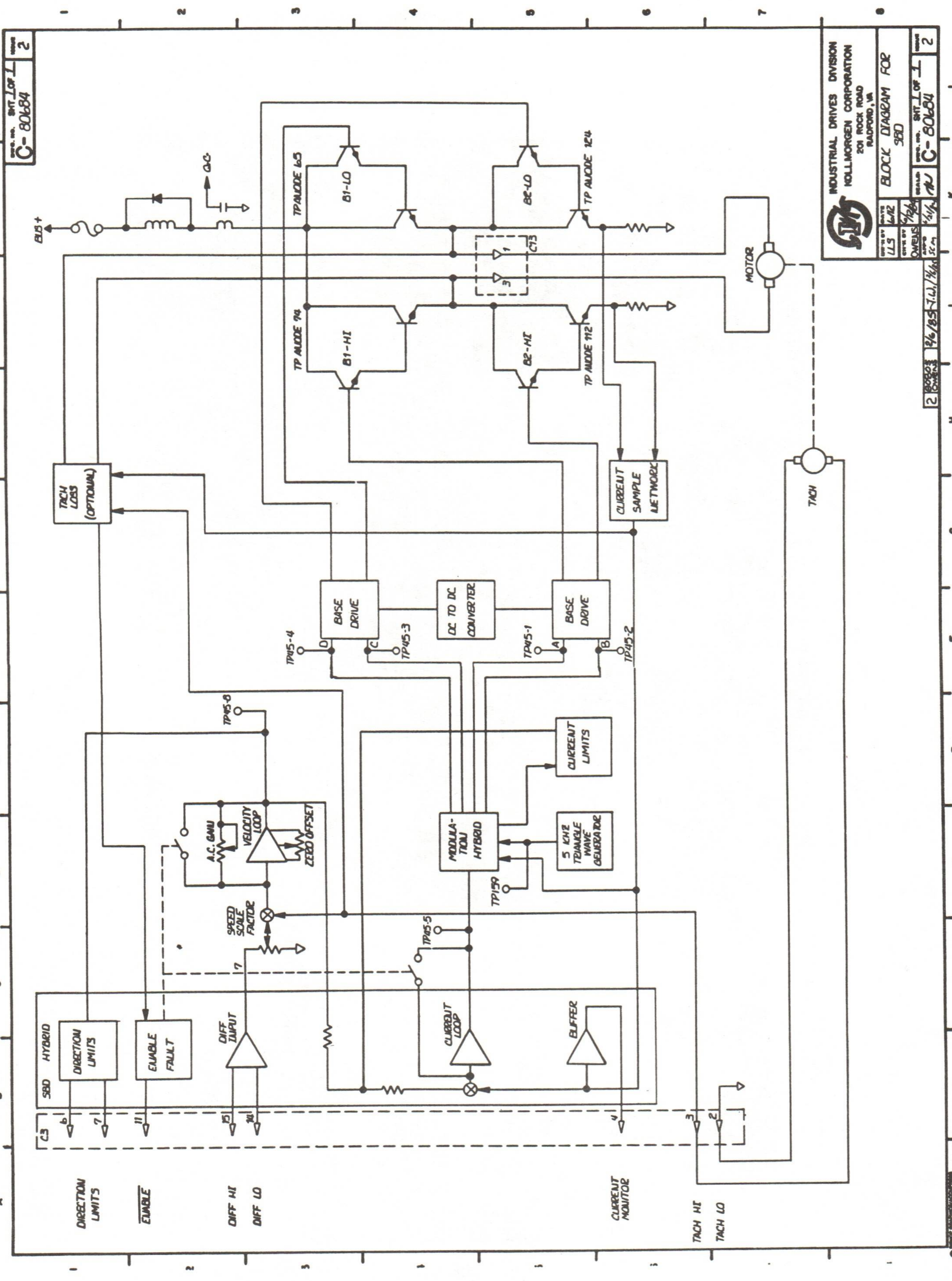
SBD2-COMP VG1
BOARD (OPTIONAL)

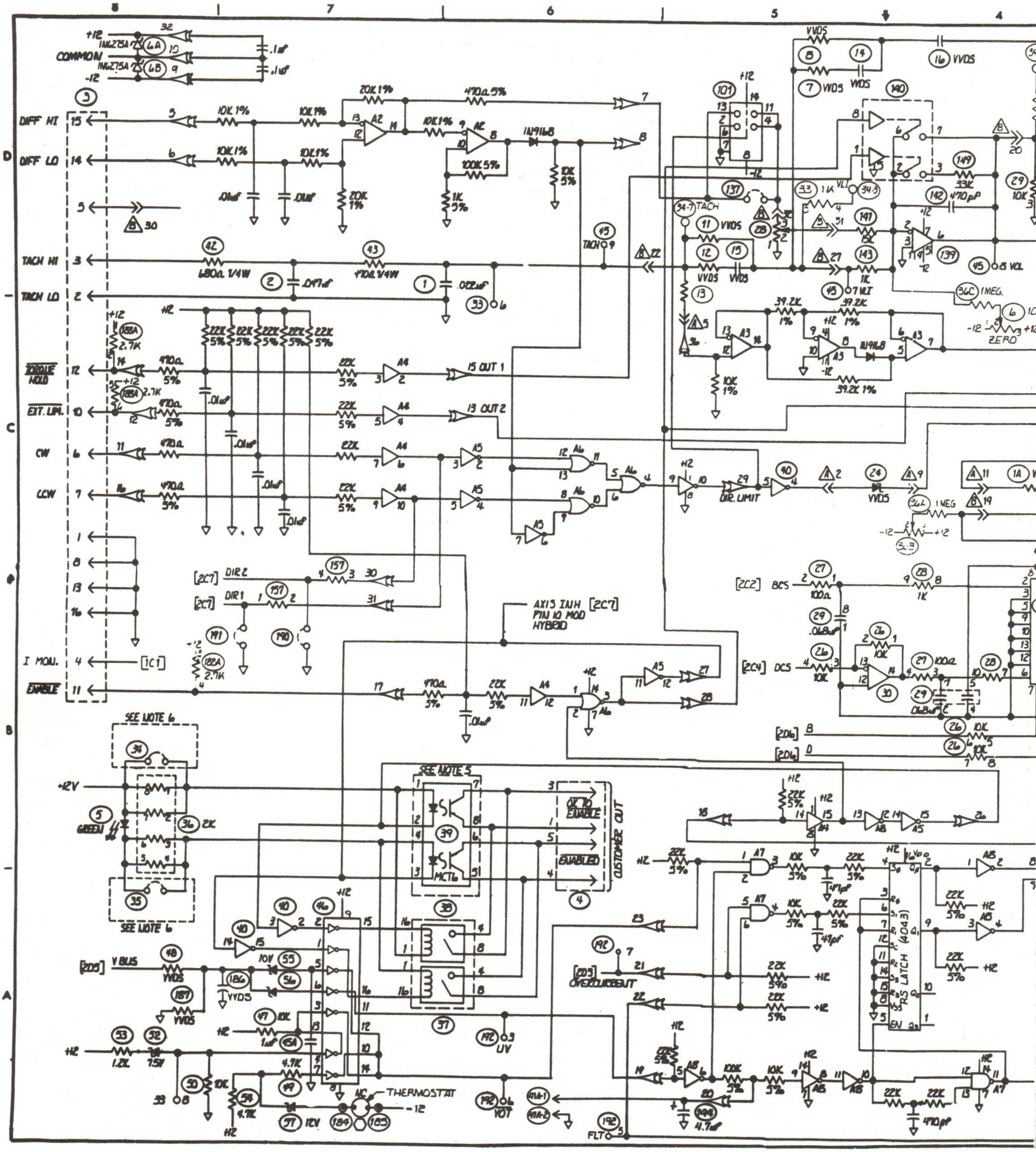
FIGURE 9

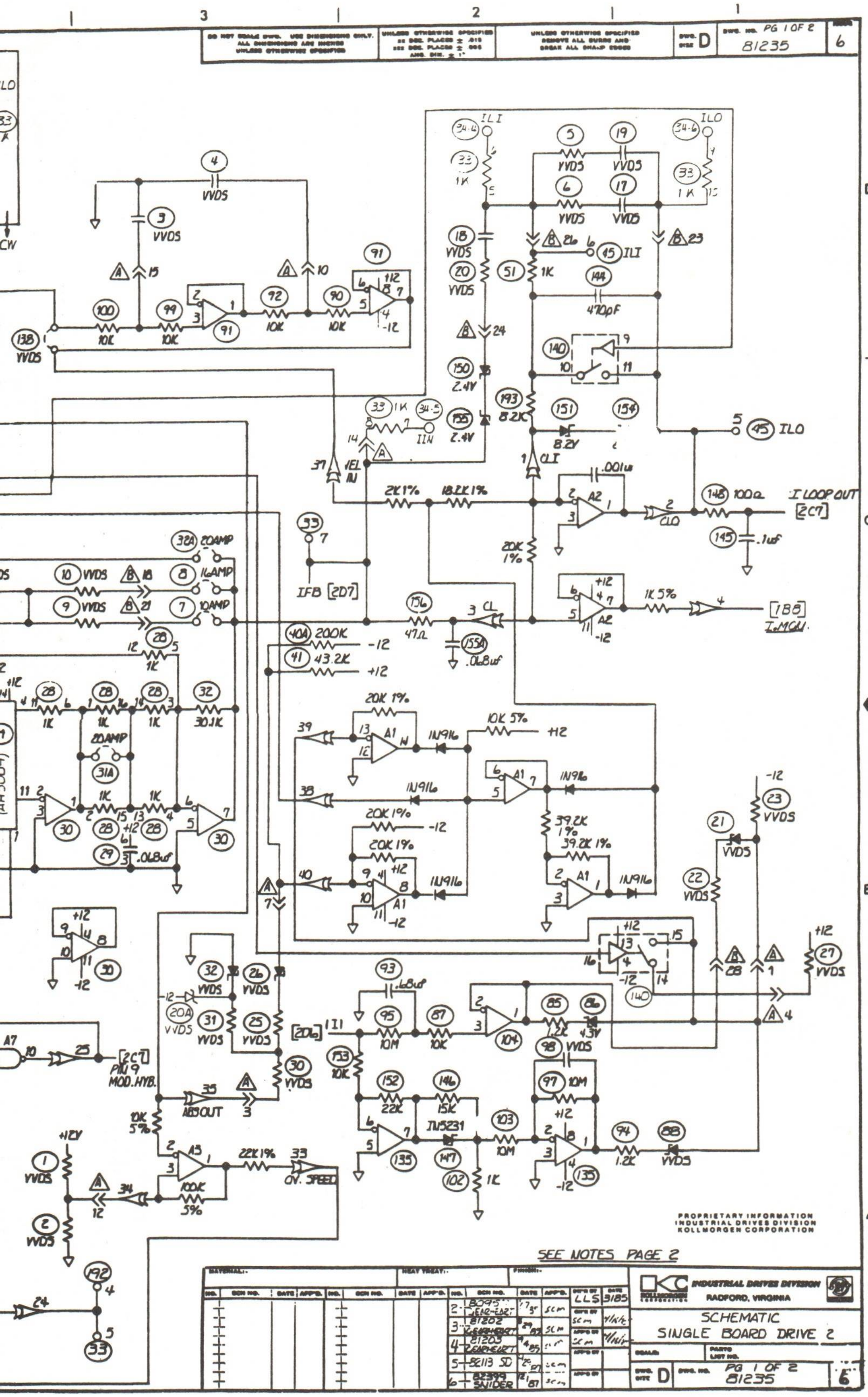


SBD2-TL1
BOARD (OPTIONAL)

FIGURE 10


INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
201 ROCK ROAD
RADFORD, VA
BLOCK DIAGRAM FOR SBD
C-80684
BUS+
QC
B1-LO
B2-LO
B1-HI
B2-HI
TP ANODE 65
TP ANODE 124
TP ANODE 74
TP ANODE 112
C13
MOTOR
TACH
TACH LOSS (OPTIONAL)
CURRENT SAMPLE NETWORK
BASE DRIVE
DC TO DC CONVERTER
BASE DRIVE
TP45-4
TP45-3
TP45-1
TP45-2
TP45-8
CURRENT LIMITS
MODULATION HYBRID
5 KHZ TRIANGLE WAVE GENERATOR
TP159
A.C. GAIN
VELOCITY LOOP
ZERO OFFSET
SPEED SCALE FACTOR
TP45-5
SBD HYBRID
DIRECTION LIMITS
ENABLE FAULT
DIFF INPUT
CURRENT LOOP
BUFFER
DIRECTION LIMITS
ENABLE
DIFF HI
DIFF LO
CURRENT MONITOR
TACH HI
TACH LO

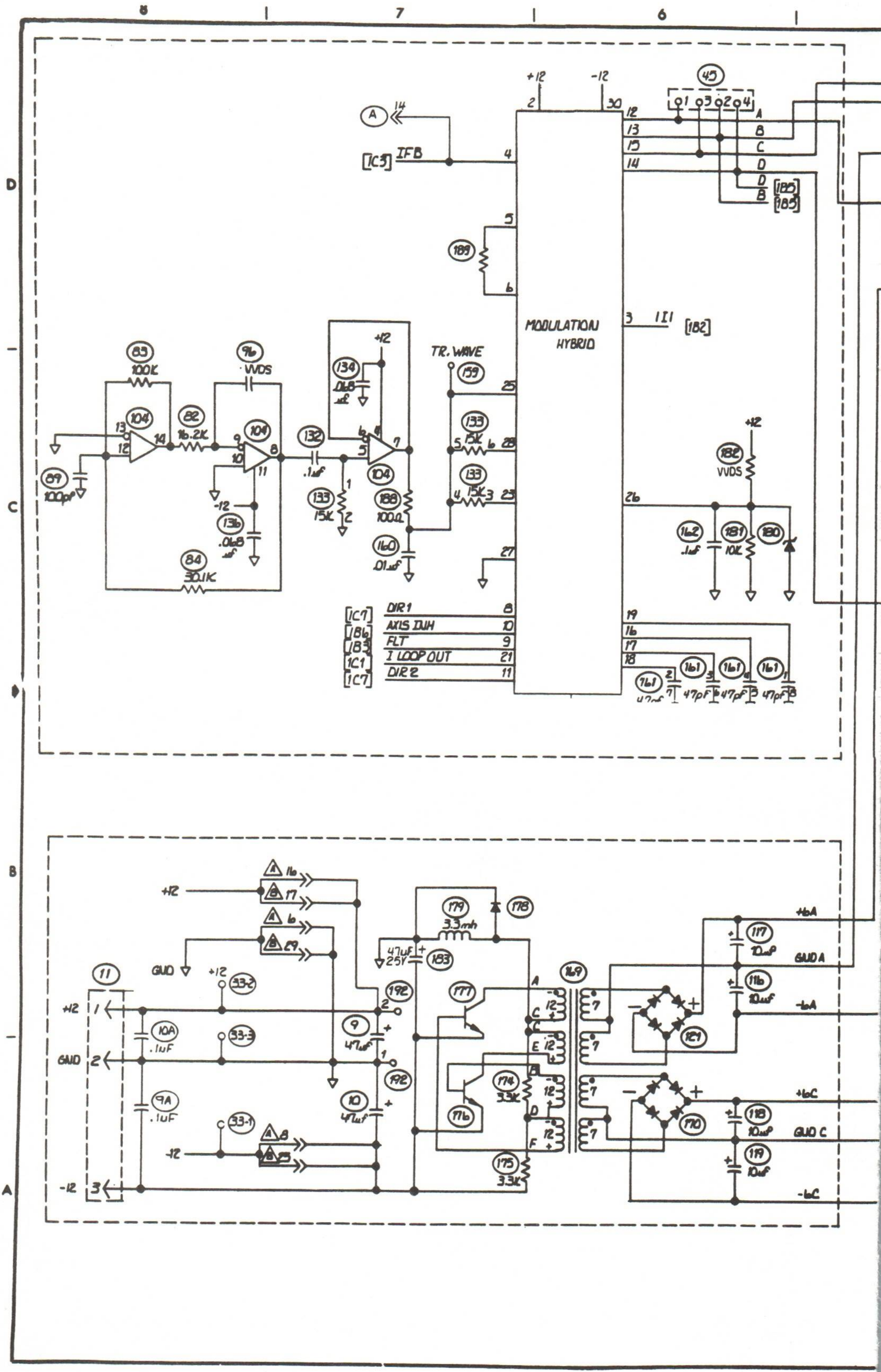

DIFF HI
DIFF LO
TACH HI
TACH LO
TORQUE HOLD
EXT. LIM.
CW
CCW
I MON.
ENABLE
COMMON
+12
-12
1N6275A
TACH
VVDS
DIR. LIMIT
ZERO
1 MEG.
AXIS INH [2C7]
PIN 10 MOD
HYBRID
DIR 2
DIR 1
[2C7]
[2C2] BCS
[2C4] DCS
[2C1]
[2D6] B
[2D6] D
15 OUT 1
13 OUT 2
SEE NOTE 6
SEE NOTE 5
+12V
GREEN
MCT6
OK TO ENABLE
ENABLED
CUSTOMER OUT
[2D5] V BUS
[2D3] OVERCURRENT
RS LATCH (4043)
THERMOSTAT
UV
VOT
FLT
1N916B
1N914B



INDUSTRIAL DRIVES DIVISION
RADFORD, VIRGINIA

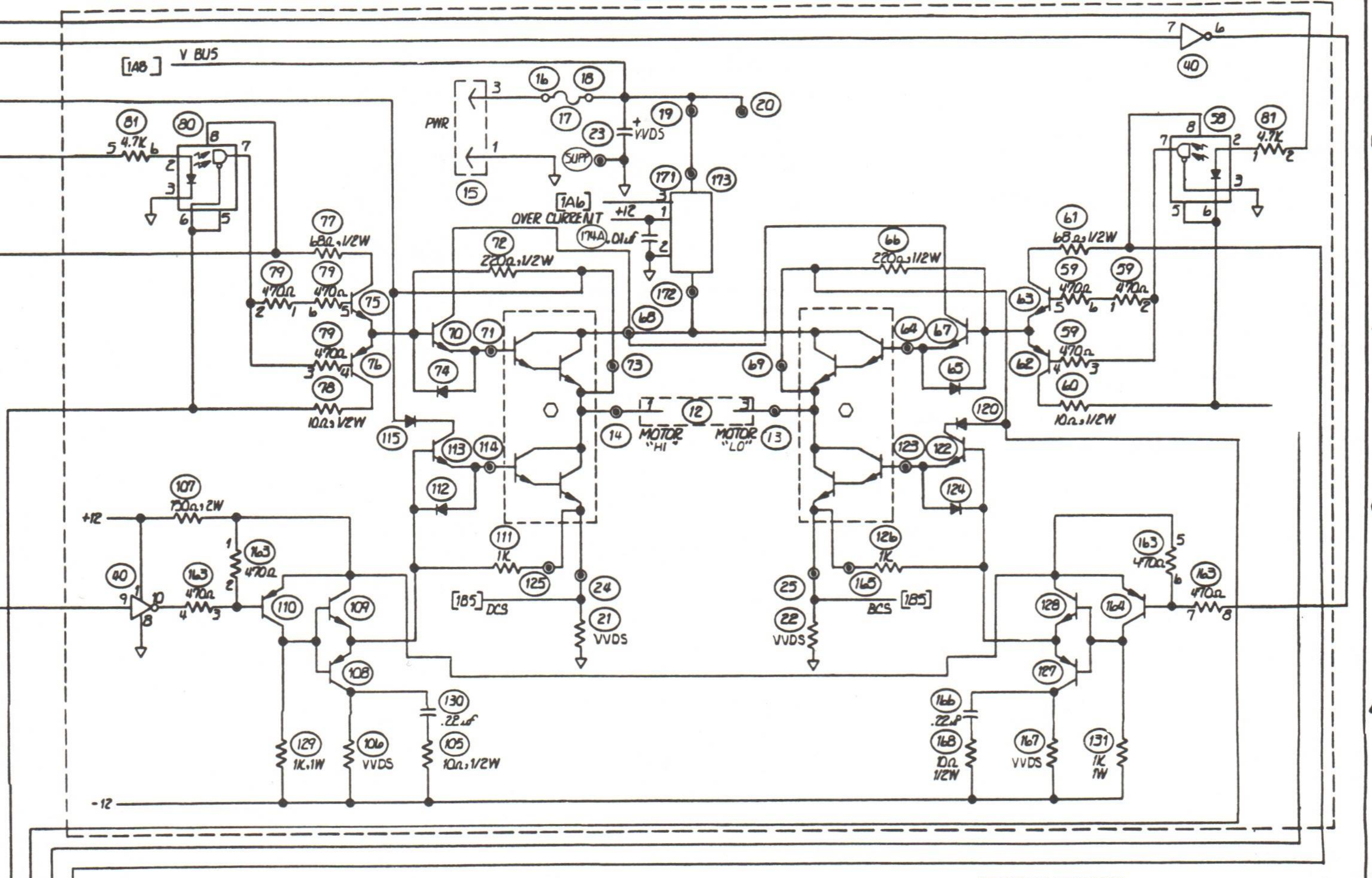
SCHEMATIC
SINGLE BOARD DRIVE 2

DWG. SIZE D — DWG. NO. PG 1 OF 2 81235 — REV. 6



8
7
6
D
C
B
A
MODULATION HYBRID
IFB
[1C3]
TR. WAVE
I LOOP OUT
DIR 1
AXIS INH
FLT
DIR 2
[1C7]
[1B6]
[1B3]
[1C1]
[1C7]
[1B2]
[1B5]
[1B3]
I I1
100K
16.2K
30.1K
100pF
VVDS
.068 uf
15K
100Ω
.01uf
.1uf
10K
47pF
3.3mh
47uF 25V
3.3K
10uF
.1uF
47uf
+12
-12
GND
+6A
GND A
-6A
+6C
GND C
-6C

D	PG 2 OF 2 81235	6



PROPRIETARY INFORMATION
INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION

NOTES:

1. – ◯ – DENOTES COMPONENTS LOCATED ON CONTROL BOARD.
2. – ⬡ – DENOTES COMPONENTS LOCATED ON HEAT SINK ASSEMBLY.
3. –›› – DENOTES CONNECTION ON COMP CARD.
4. ◁ DENOTES CONNECTION SBD HYBRID.
5. AREAS REFERENCED BY THIS NOTE INDICATES STANDARD COMPONENTS.
6. AREAS REFERENCED BY THIS NOTE INDICATES OPTIONAL COMPONENTS.

COMPONENT	SIGNAL	LOCATION	COMPONENT	SIGNAL	LOCATION
TP192-1	GND	2A7	TP45-7	VLI	1D5
2	+12	2B7	8	VLO	1D4
3	UV	1A6	9	TACH	1D6
4	RESET	1A4	CONN 33 1	-12	2A8
5	$\overline{FLT}$	1A6	2	+12	2B8
6	$\overline{VOT}$	1A6	3	GND	2A8
7	$\overline{OC}$	1A6	4	OPEN	
TP45-1	A	2D6	5	RESET	1A4
2	B	2D6	6	TACH	1C6
3	C	2D6	7	IFB	1C3
4	D	2D6	8	$\overline{TL}$	1A8
5	I LO	1D1			
6	I LI	1D2			

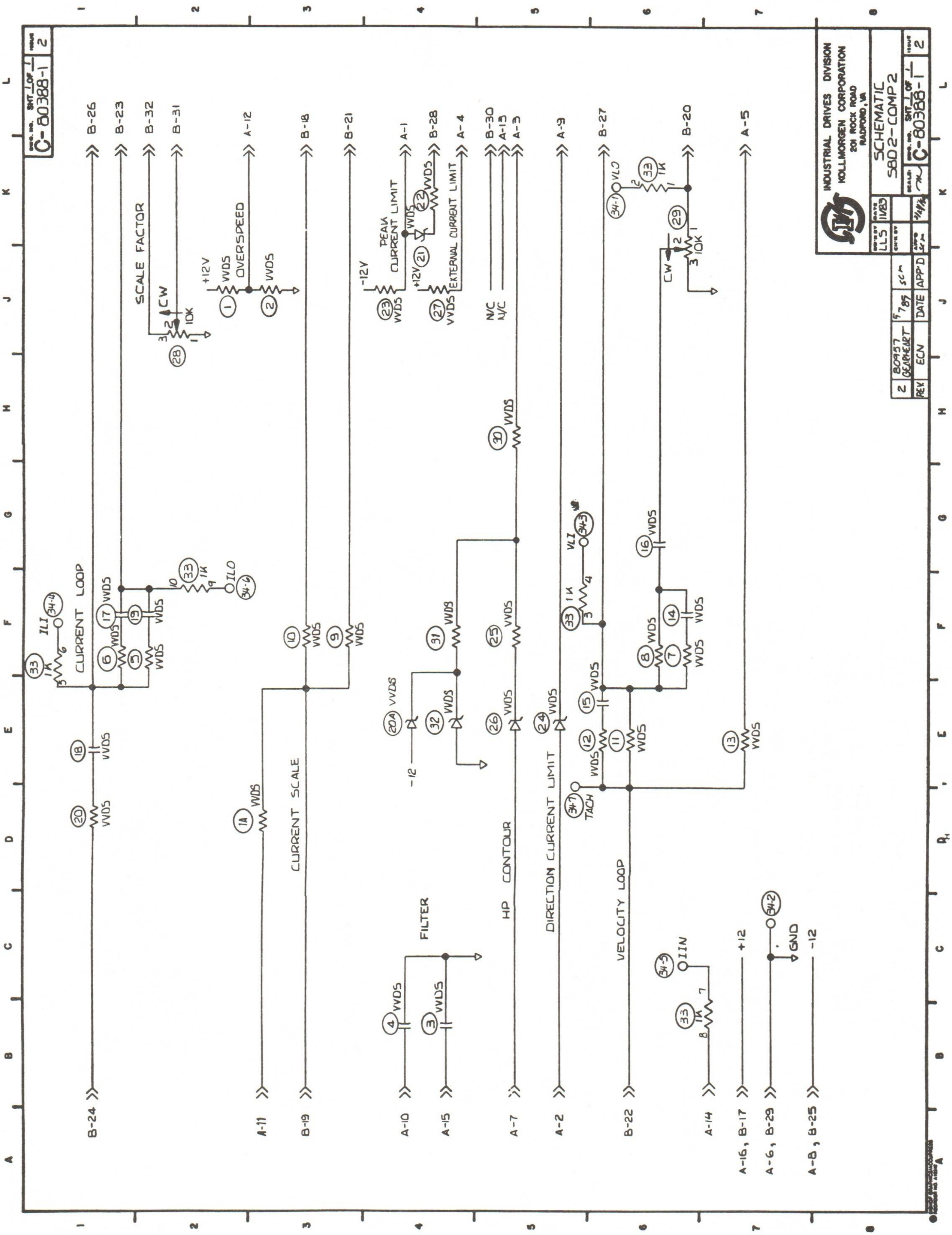
		LF351BN	139
		LF353BN	91, 135
		LF347BN	30, 104
		DG201	140
		2N3906	110, 164
		2N6487	176, 177
MPSU56	62, 76, 108, 127	VE18X	121, 170
MPSU06	63, 75, 109, 128	ULN2004A	46
1N5242B	57	HCPL-2200	58, 80
1N5236B	52, 151, 154	IH 5009-CPD	31
1N5231B	147	RL-1283-3300	179
1N5227B	56	1N4935	65, 74, 112, 124, 178
1N5225B	180	4049B	40
1N5221B	150, 155	1N5819	115, 180
67X10K POT	6	2SC3047	67, 70, 113, 122
DESC. OR EQUIV.	COMPONENT NO.	DESC. OR EQUIV.	COMPONENT NO.

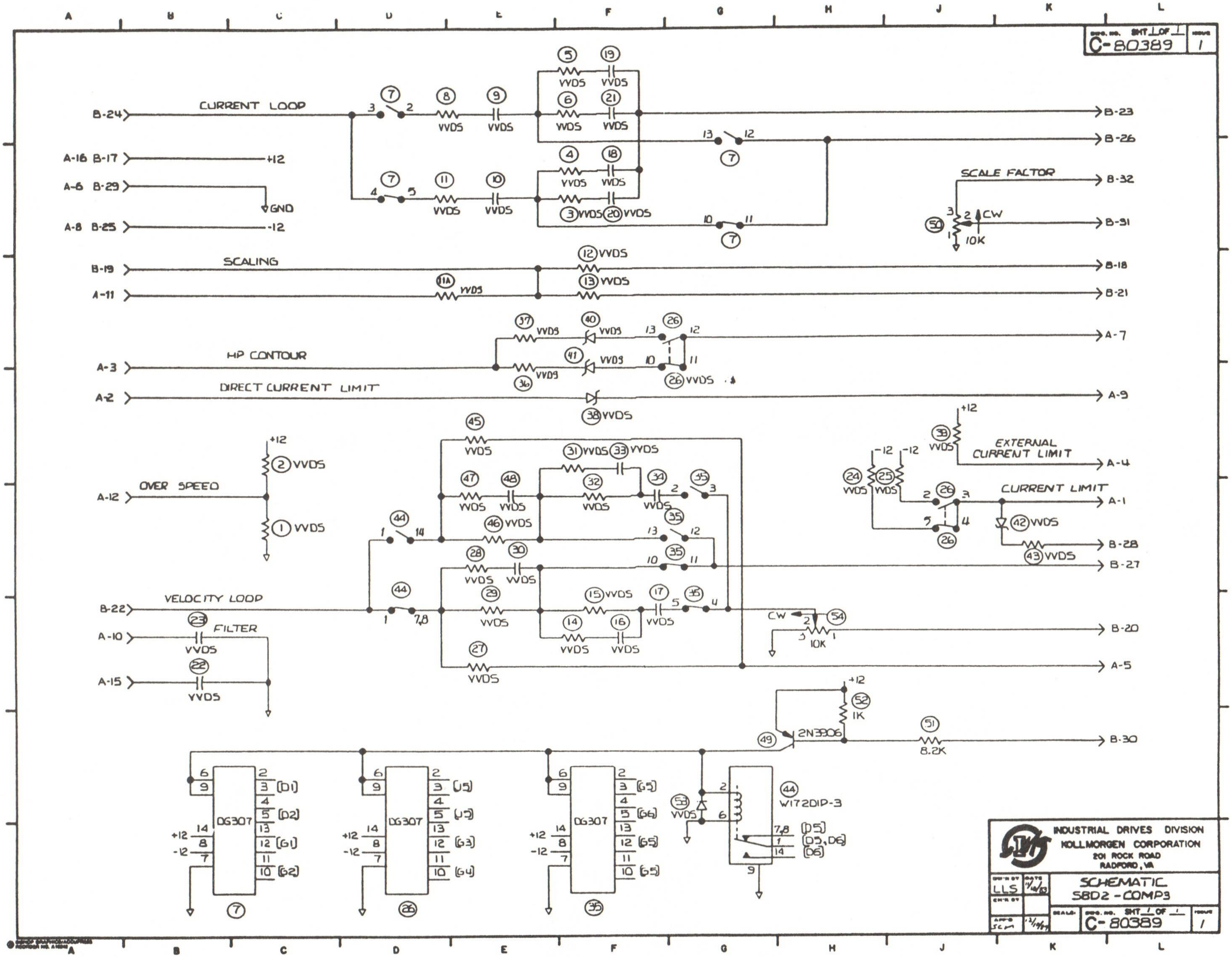
KOLLMORGEN CORPORATION INDUSTRIAL DRIVES DIVISION
RADFORD, VIRGINIA

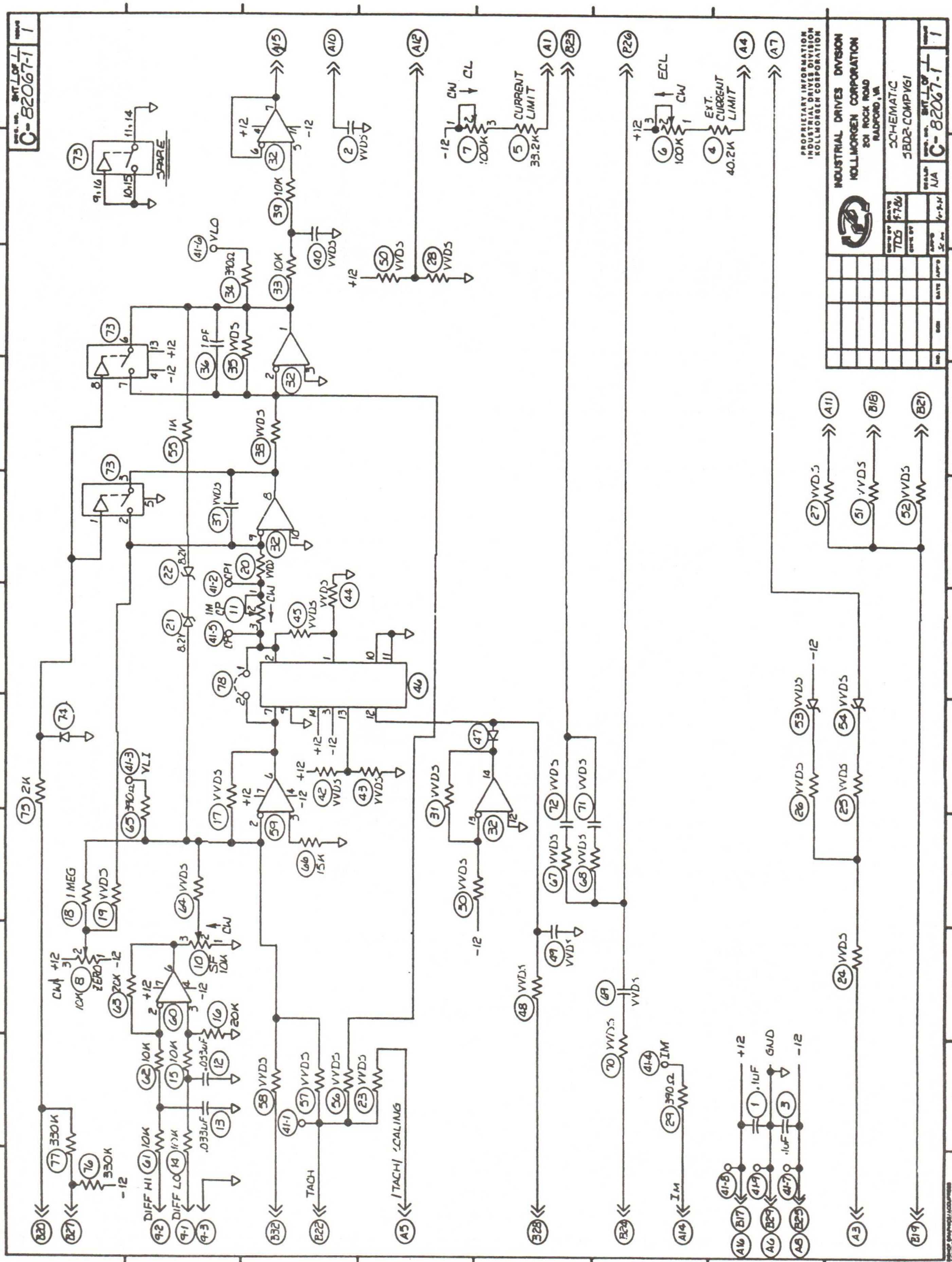
SCHEMATIC
SINGLE BOARD DRIVE 2

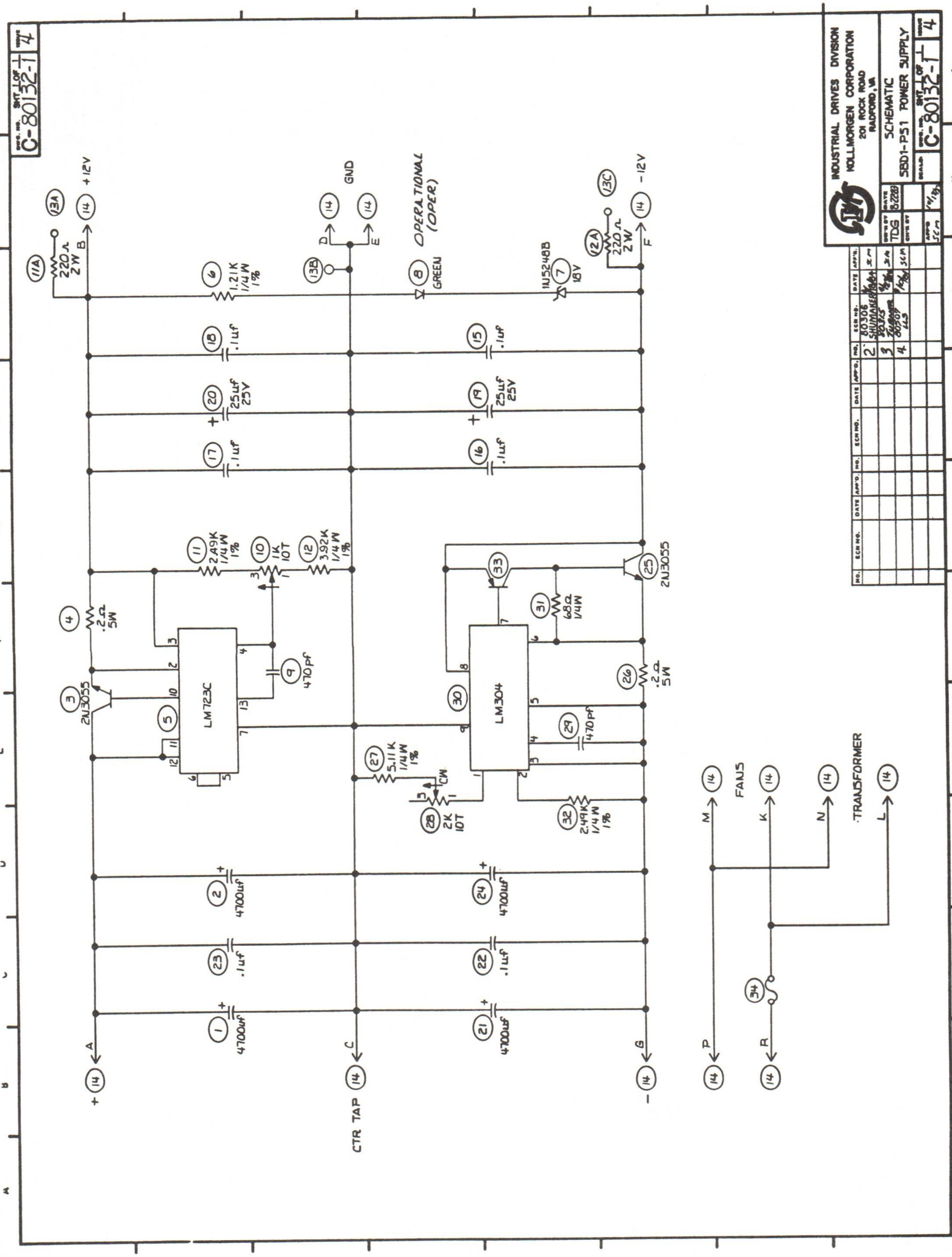
DRWN BY LLS 3/85
CHKD BY SCM 4/1/85
APPD BY SCM 4/1/85

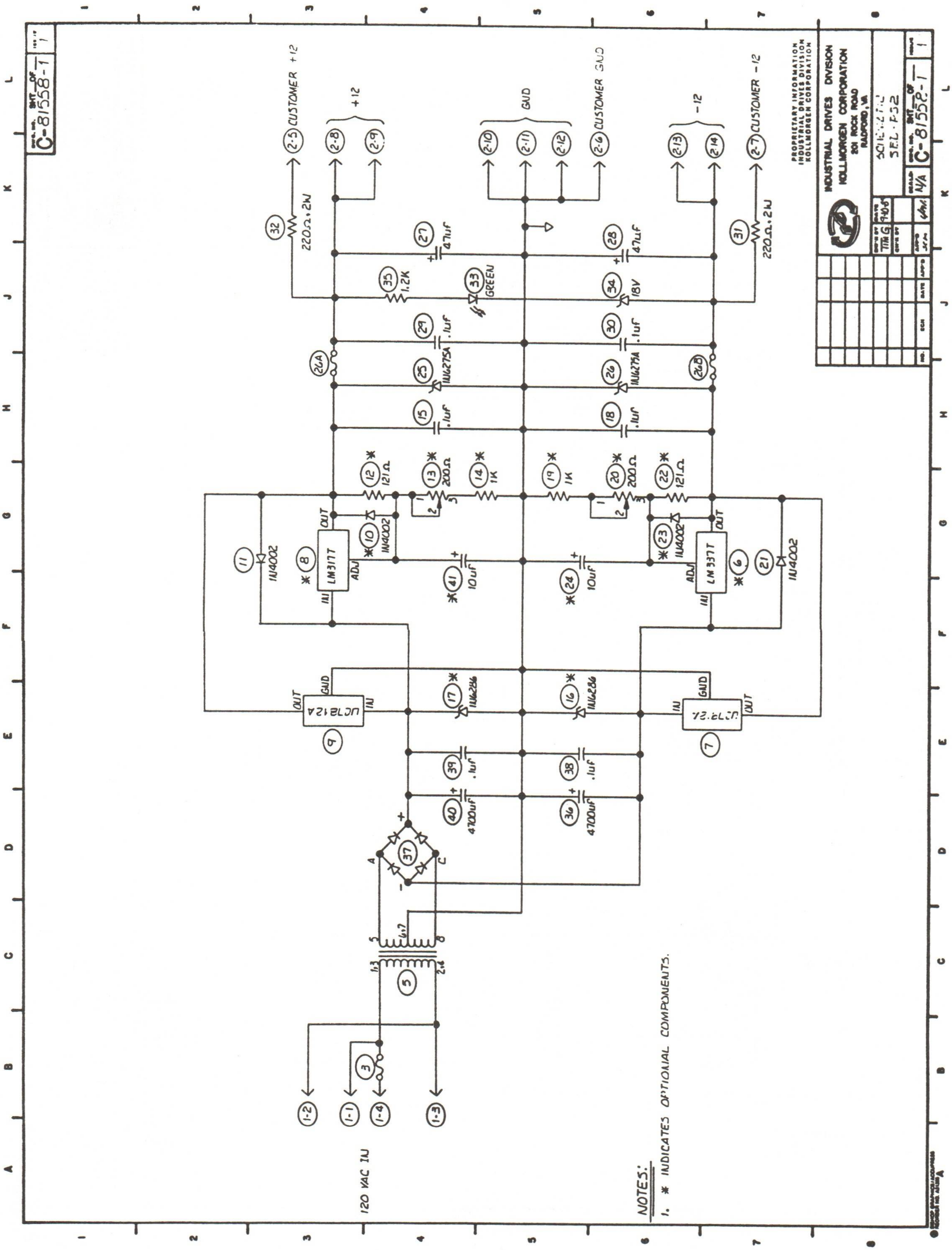
DWG SIZE D DWG NO. PG 2 OF 2 81235 REV 6


INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
201 ROCK ROAD
RADFORD, VA
SCHEMATIC
SBD2-COMP2
C-80388-1
2
80957 GEARHEART
REV
ECN
DATE
APP'D
CURRENT LOOP
SCALE FACTOR
OVERSPEED
PEAK CURRENT LIMIT
EXTERNAL CURRENT LIMIT
CURRENT SCALE
FILTER
HP CONTOUR
DIRECTION CURRENT LIMIT
VELOCITY LOOP
TACH
GND
ILI
ILO
VLI
VLO
IIN
CW
10K
1K
+12V
-12V
VVDS
N/C
B-26
B-23
B-32
B-31
A-12
B-18
B-21
A-1
B-28
A-4
B-30
A-13
A-3
A-9
B-27
B-20
A-5
B-24
A-11
B-19
A-10
A-15
A-7
A-2
B-22
A-14
A-16, B-17
A-6, B-29
A-8, B-25
+12
-12

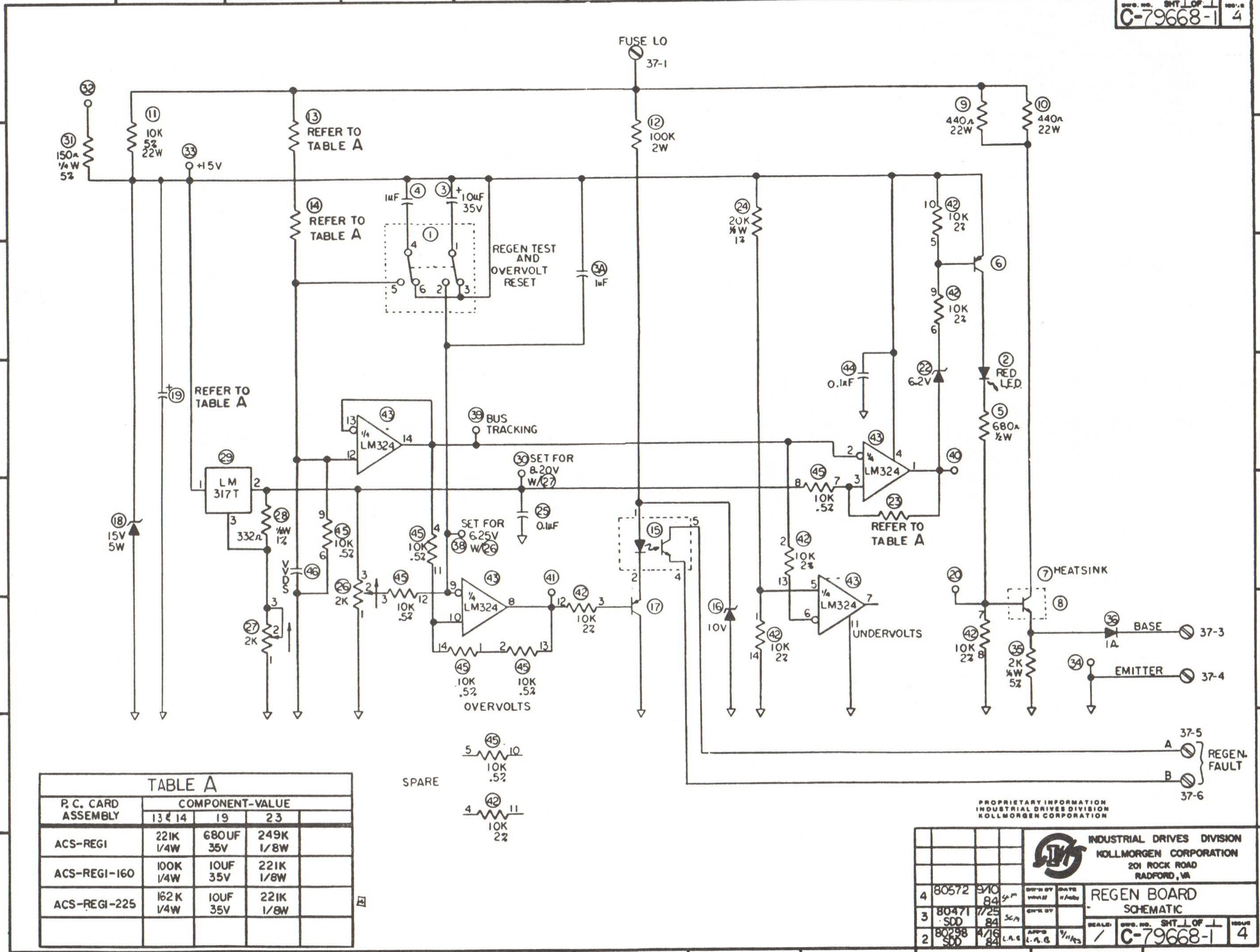

CURRENT LOOP
SCALING
HP CONTOUR
DIRECT CURRENT LIMIT
OVER SPEED
VELOCITY LOOP
FILTER
SCALE FACTOR
EXTERNAL CURRENT LIMIT
CURRENT LIMIT
B-24
A-16 B-17
A-6 B-29
A-8 B-25
B-19
A-11
A-3
A-2
A-12
B-22
A-10
A-15
B-23
B-26
B-32
B-31
B-18
B-21
A-7
A-9
A-4
A-1
B-28
B-27
B-20
A-5
B-30
+12
GND
-12
VVDS
10K
CW
1K
8.2K
2N3906
W172DIP-3
DG307
INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
201 ROCK ROAD
RADFORD, VA
SCHEMATIC
SBD2-COMP3
C-80389


PROPRIETARY INFORMATION
INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
201 ROCK ROAD
RADFORD, VA
SCHEMATIC
SBD2-COMP VG1
C-82067-1

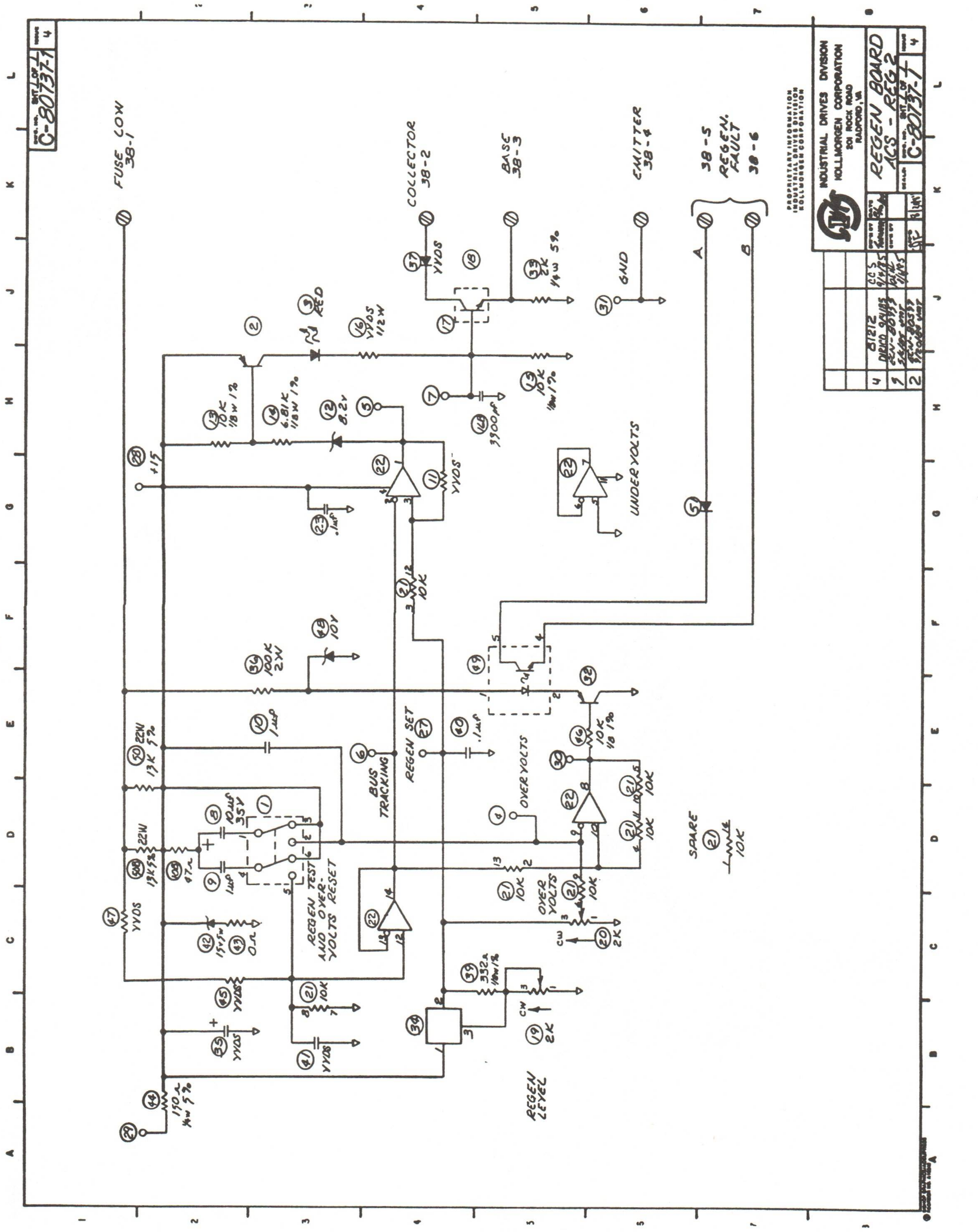

INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
201 ROCK ROAD
RADFORD, VA
SCHEMATIC
SBD1-PS1 POWER SUPPLY
C-80132-1
LM723C
LM304
2N3055
1N5248B
TRANSFORMER
FANS
CTR TAP
GND
+12V
-12V
OPERATIONAL
(OPER)
GREEN

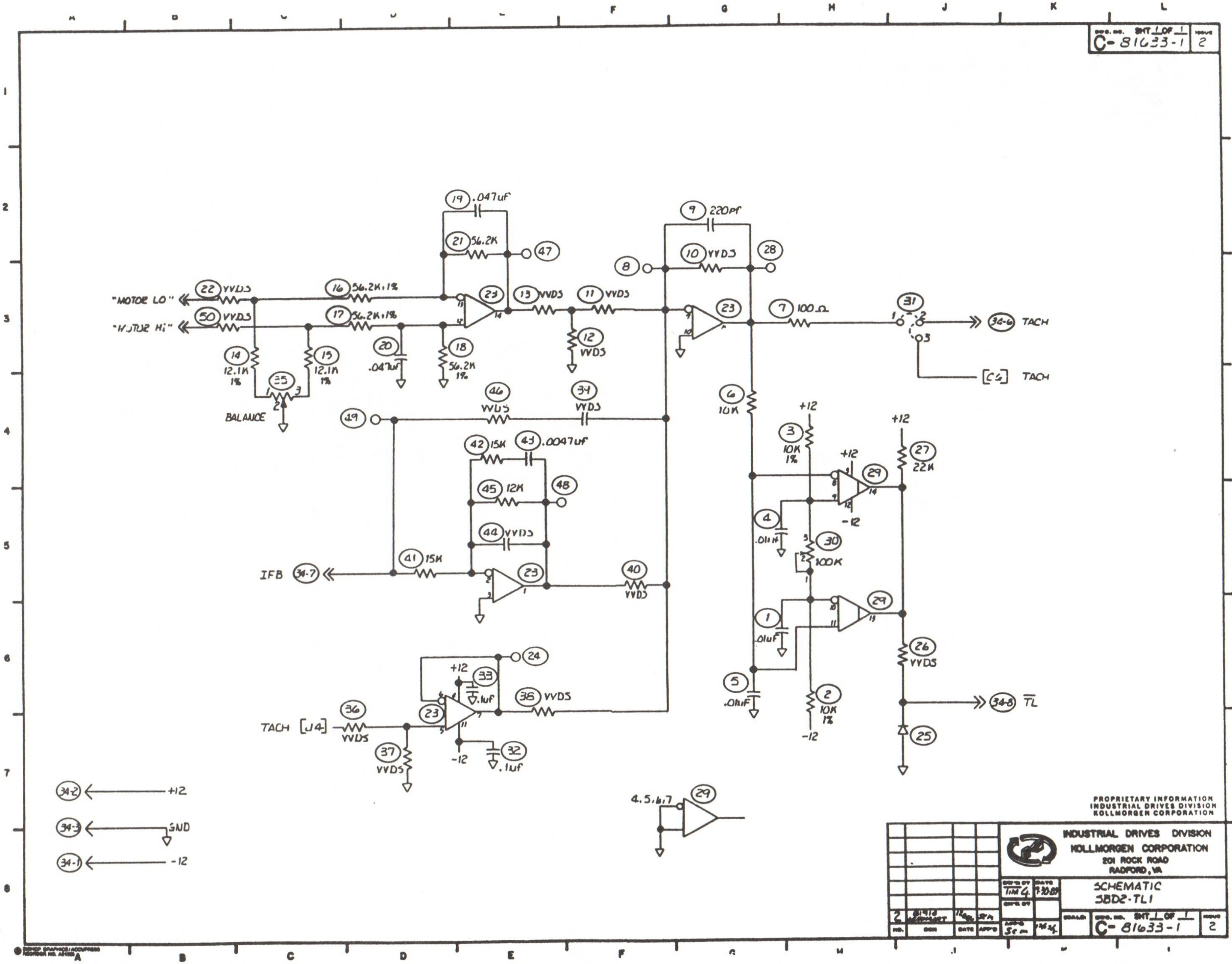


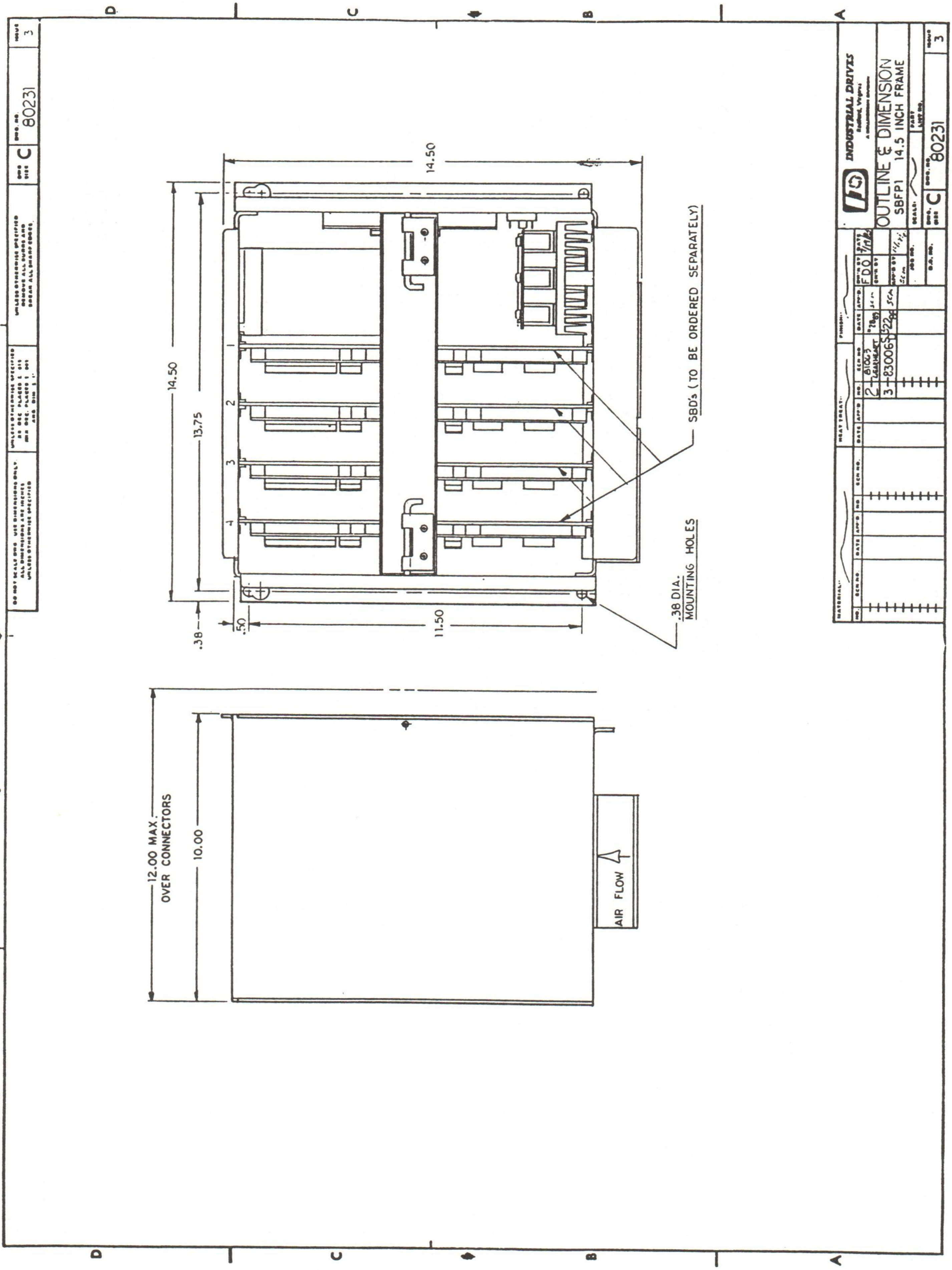
C-81558-1
CUSTOMER +12
CUSTOMER GND
CUSTOMER -12
+12
GND
-12
220Ω, 2W
1.2K
GREEN
18V
47uF
.1uF
1N6275A
121Ω
200Ω
1K
1N4002
LM317T
LM337T
10uF
UC7812A
1N6286
4700uF
120 VAC IN
NOTES:
1. * INDICATES OPTIONAL COMPONENTS.
PROPRIETARY INFORMATION
INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
201 ROCK ROAD
RADFORD, VA
SCHEMATIC
SEL-P52
N/A
C-81558-1

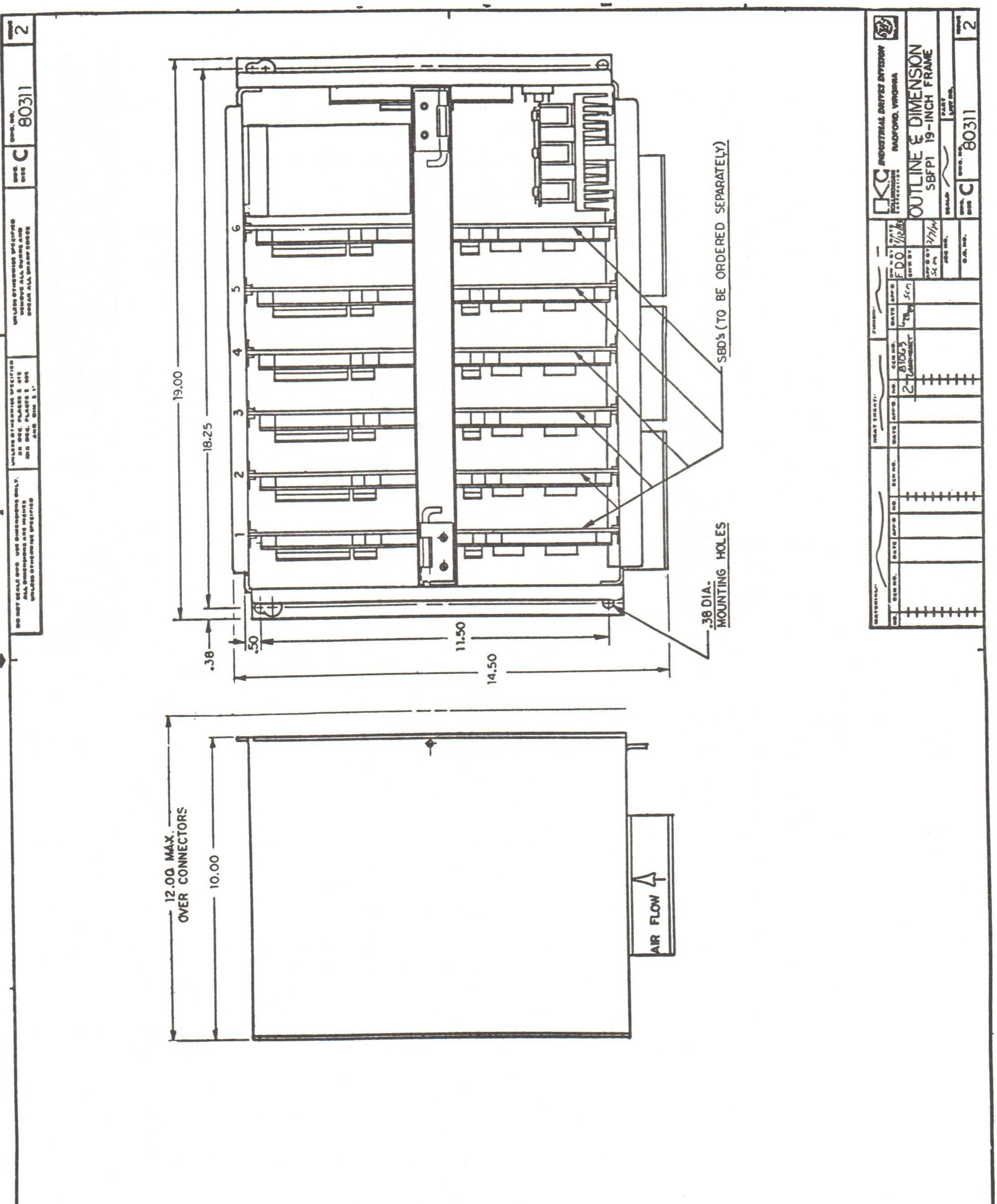


P.C. CARD ASSEMBLY	COMPONENT-VALUE			
	13 & 14	19	23	
ACS-REGI	221K 1/4W	680UF 35V	249K 1/8W	
ACS-REGI-160	100K 1/4W	10UF 35V	221K 1/8W	
ACS-REGI-225	162K 1/4W	10UF 35V	221K 1/8W	

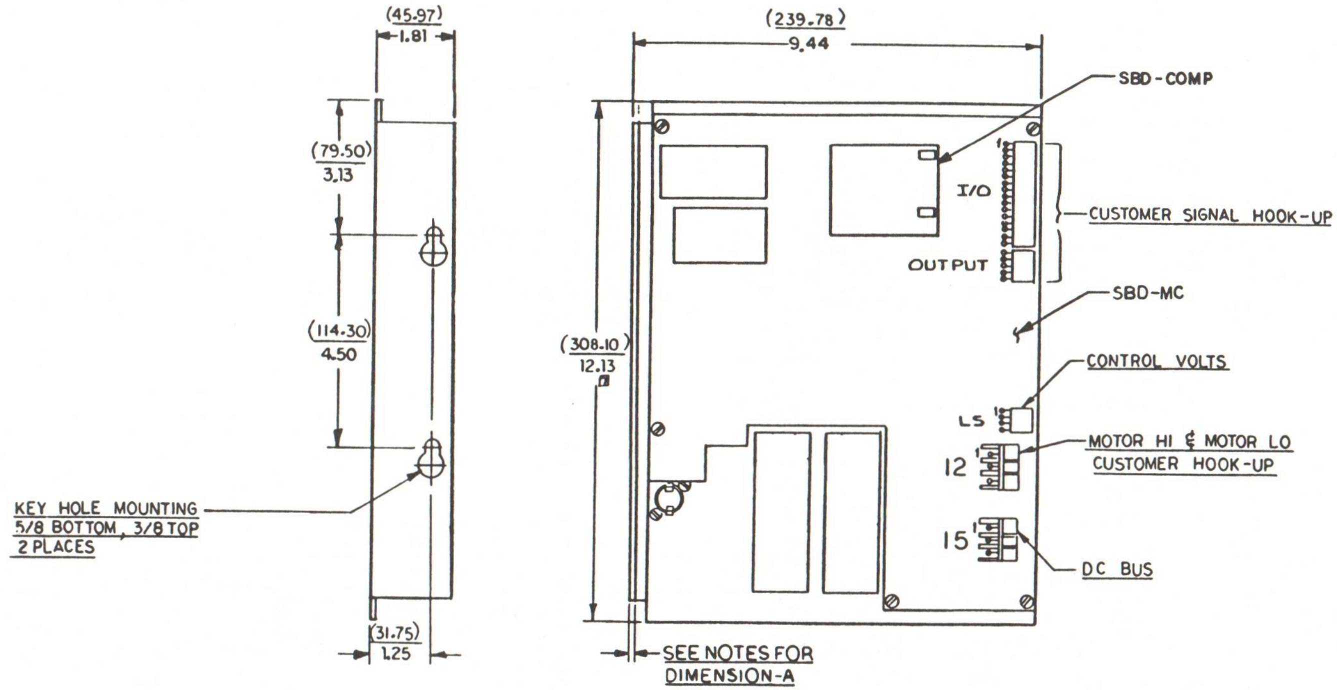

INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
201 ROCK ROAD
RADFORD, VA
REGEN BOARD
ACS - REG 2
C-80737-1
FUSE LOW
38-1
COLLECTOR
38-2
BASE
38-3
EMITTER
38-4
38-5
REGEN. FAULT
38-6
UNDERVOLTS
OVERVOLTS
BUS TRACKING
REGEN SET
REGEN LEVEL
SPARE


"MOTOR LO"
"MOTOR HI"
BALANCE
IFB
TACH
TL
+12
GND
-12
PROPRIETARY INFORMATION
INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
INDUSTRIAL DRIVES DIVISION
KOLLMORGEN CORPORATION
201 ROCK ROAD
RADFORD, VA
SCHEMATIC
3BD2-TL1
C- 81633-1


OUTLINE & DIMENSION
SBFP1 14.5 INCH FRAME
INDUSTRIAL DRIVES
C
80231
3
14.50
13.75
.38
.50
11.50
SBD's (TO BE ORDERED SEPARATELY)
.38 DIA. MOUNTING HOLES
12.00 MAX. OVER CONNECTORS
10.00
AIR FLOW
FDO
8300659



SBD's (TO BE ORDERED SEPARATELY)
.38 DIA. MOUNTING HOLES
19.00
18.25
11.50
14.50
.38
.50
12.00 MAX. OVER CONNECTORS
10.00
AIR FLOW
1
2
3
4
5
6
OUTLINE & DIMENSION
SBFP1 19-INCH FRAME
INDUSTRIAL DRIVES DIVISION
RADFORD, VIRGINIA
C
80311
2



NOTES:
1) SBD2-06 } A = .125 (3.18)
2) SBD2-10 }
3) SBD2-16 }
4) SBD2-20, A = .25
5) WHEN MOUNTING MORE THAN ONE AXIS WITHOUT FRAME ASSEMBLY, AXIS MUST NOT BE CLOSER THAN 2" CENTER TO CENTER.

6) DIMENSION = $\frac{(MM)}{INCHES}$

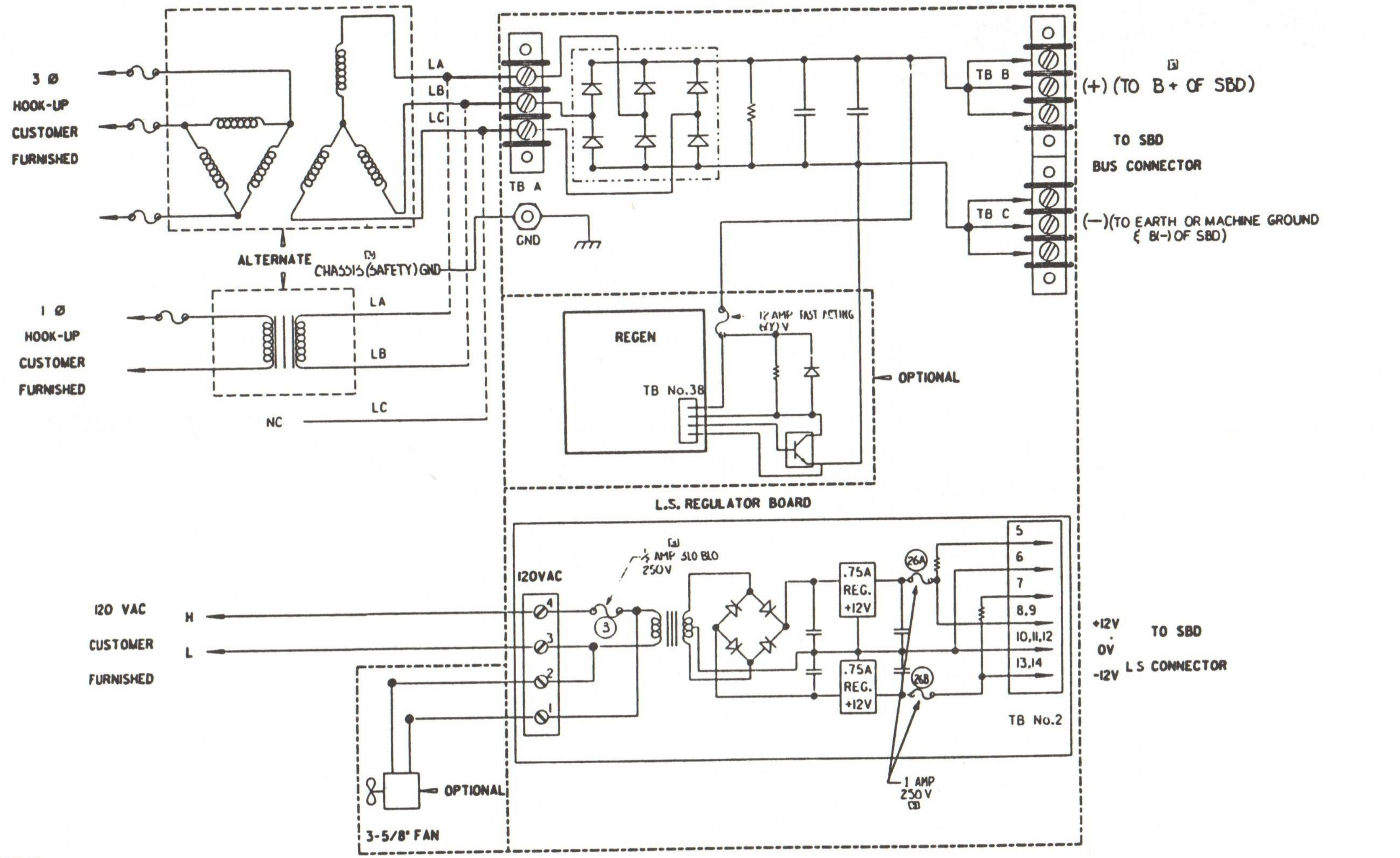
KOLLMORGEN CORPORATION — INDUSTRIAL DRIVES DIVISION, RADFORD, VIRGINIA

OUTLINE & DIMENSION SBD2

DWG SIZE C — DWG NO. 80447 — ISSUE 7

NO	ECN NO	DATE	APP'D
2	80310 OWENS	7/9/84	SCM
3	80418 SHUMAKER	2/84	SCM
4	80455 SHUMAKER	7/19/84	SCM
5	81074 OWENS	4/2/85	SCM
6	81084 OWENS	7/1/85	OWENS
7	81190 OWENS	7/2/85	SCM

DR: DIRICO 12/9/83



NOTES:

1) LONG & SHORT DASH LINE SHOWS VENDOR FURNISHED COMPONENTS AND VENDOR CONNECTIONS.

2) COMPONENTS AND CONNECTIONS OUTSIDE THIS LINE ARE TO BE CUSTOMER FURNISHED.

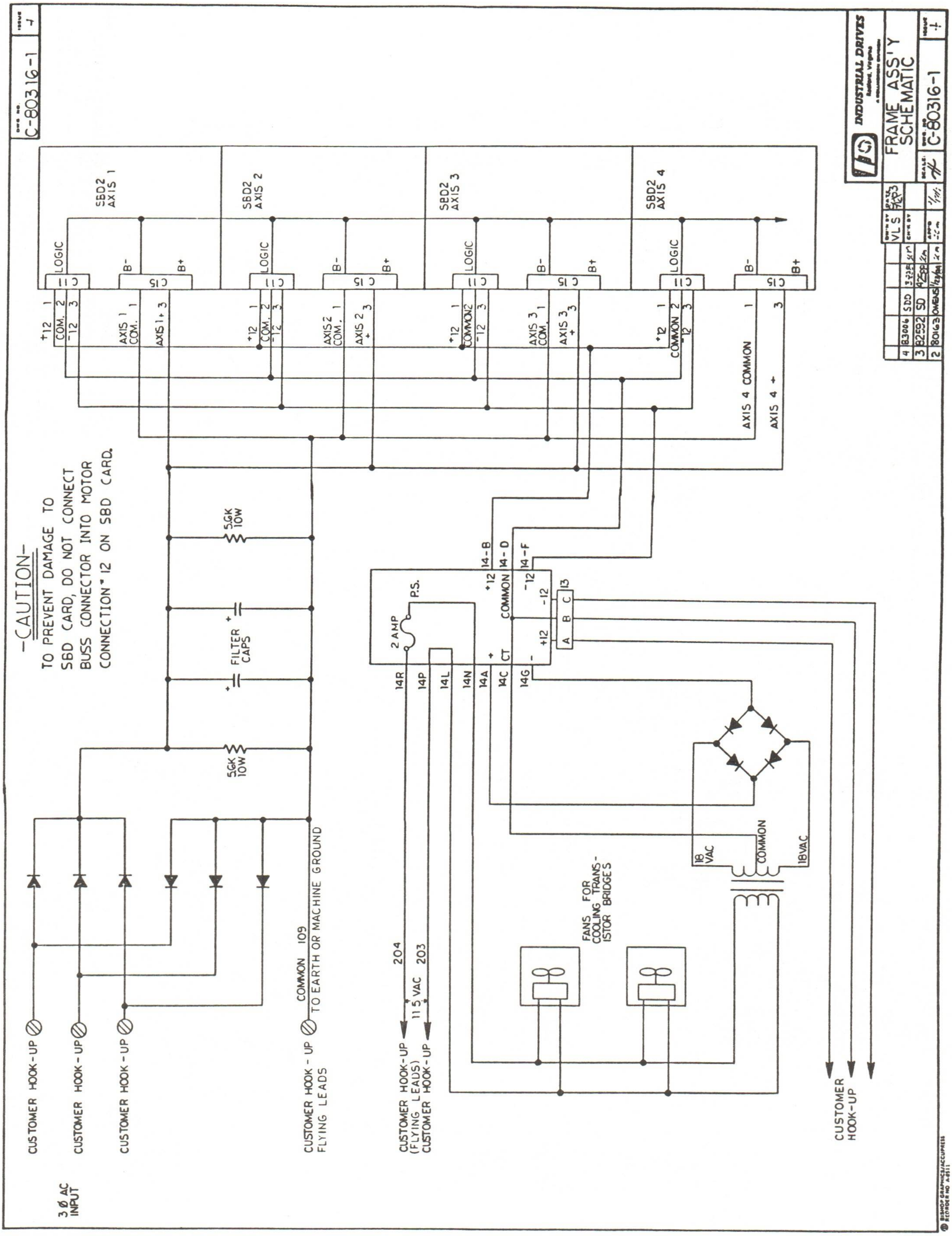
3) AIR FLOW FROM FAN SHOULD BE TOWARD SBD AMP, WHICH SHOULD BE MOUNTED TO THE LEFT OF THE POWER SUPPLY S3PI-15

INDUSTRIAL DRIVES

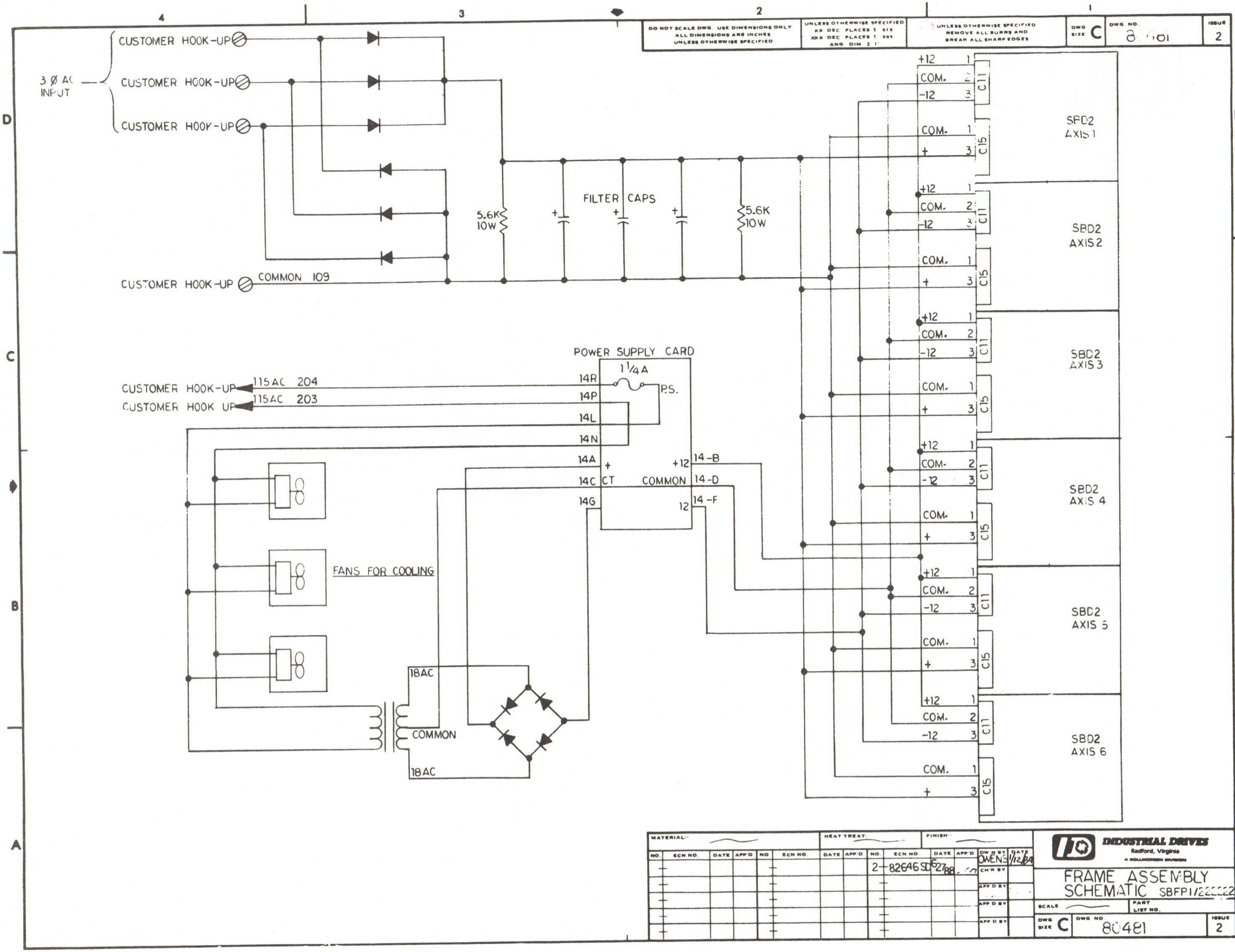
SYSTEM & INTERNAL WIRING SBPI-15

SIZE C DWG. NO. 81606 SCALE NONE SHEET 4

DRWN BY CS DATE 10-28 1985



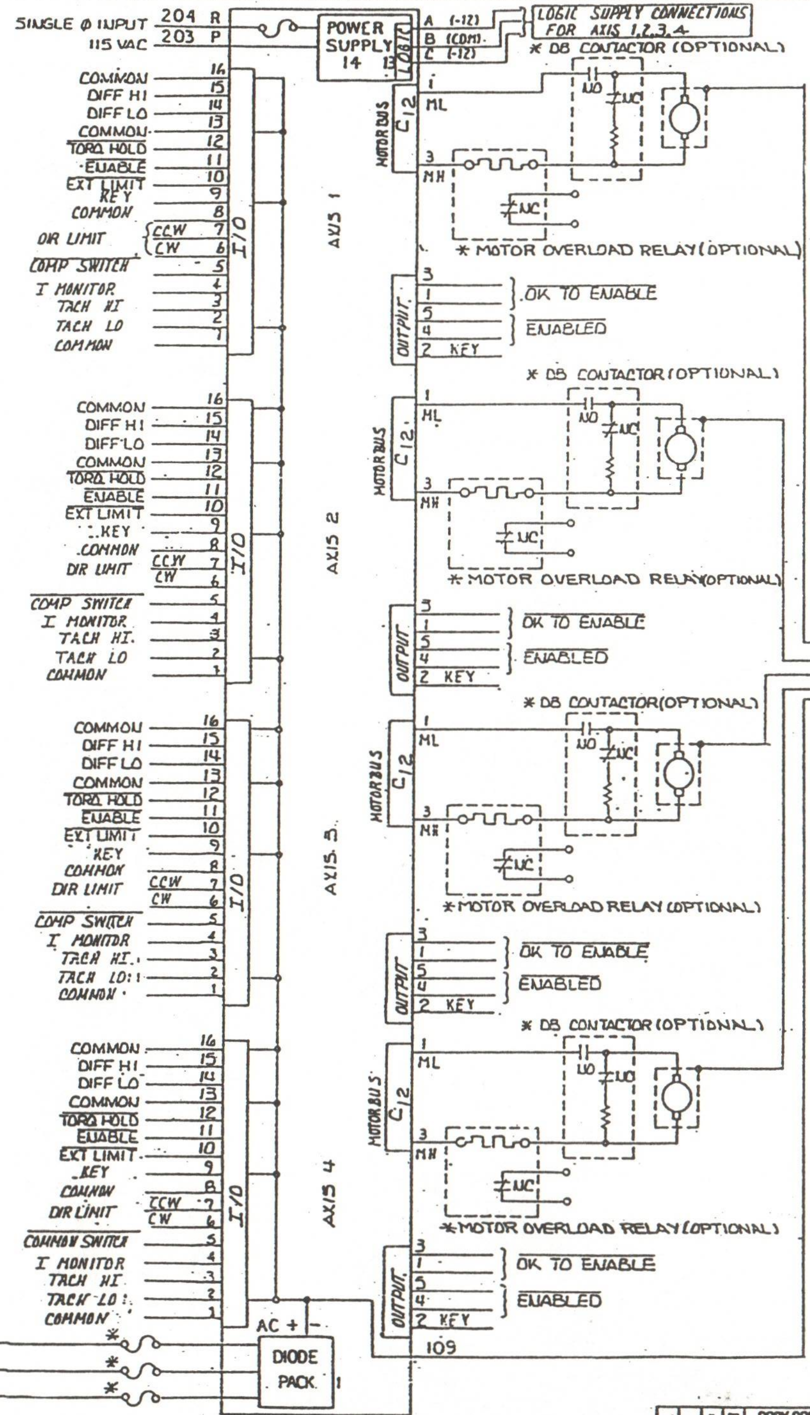
DWG NO C-80316-1
ISSUE 4
SBD2 AXIS 1
SBD2 AXIS 2
SBD2 AXIS 3
SBD2 AXIS 4
LOGIC
B-
B+
C 11
C 15
+12
COM.
-12
AXIS 1 COM.
AXIS 1 +
AXIS 2 COM.
AXIS 2 +
AXIS 3 COM.
AXIS 3 +
COMMON
AXIS 4 COMMON
AXIS 4 +
-CAUTION-
TO PREVENT DAMAGE TO SBD CARD, DO NOT CONNECT BUSS CONNECTOR INTO MOTOR CONNECTION # 12 ON SBD CARD.
5.6K 10W
FILTER CAPS
P.S.
2 AMP
14-B
14-D
14-F
14R
14P
14L
14N
14A
14C
14G
CT
13
A
B
C
18 VAC
COMMON
18VAC
FANS FOR COOLING TRANSISTOR BRIDGES
204
203
115 VAC
COMMON 109
TO EARTH OR MACHINE GROUND
CUSTOMER HOOK-UP
CUSTOMER HOOK-UP FLYING LEADS
CUSTOMER HOOK-UP (FLYING LEADS)
CUSTOMER HOOK-UP
3 Ø AC INPUT
INDUSTRIAL DRIVES
FRAME ASS'Y SCHEMATIC
C-80316-1
4 83006 SDD
3 82592 SD
2 80163 OWENS
VLS



DO NOT SCALE DWG. USE DIMENSIONS ONLY
ALL DIMENSIONS ARE INCHES
UNLESS OTHERWISE SPECIFIED
UNLESS OTHERWISE SPECIFIED REMOVE ALL BURRS AND BREAK ALL SHARP EDGES
DWG SIZE C
ISSUE 2
3 Ø AC INPUT
CUSTOMER HOOK-UP
CUSTOMER HOOK-UP
CUSTOMER HOOK-UP
CUSTOMER HOOK-UP
COMMON 109
5.6K 10W
FILTER CAPS
5.6K 10W
POWER SUPPLY CARD
1 1/4 A
P.S.
CUSTOMER HOOK-UP
115AC 204
CUSTOMER HOOK UP
115AC 203
14R
14P
14L
14N
14A
14C
14G
+
CT
+12
COMMON
12
14-B
14-D
14-F
FANS FOR COOLING
18AC
COMMON
18AC
SBD2 AXIS 1
SBD2 AXIS 2
SBD2 AXIS 3
SBD2 AXIS 4
SBD2 AXIS 5
SBD2 AXIS 6
C11
C15
+12
COM.
-12
COM.
+
MATERIAL
HEAT TREAT
FINISH
NO. ECN NO. DATE APP'D
2 82646 SD 6-27-88
DWN BY OWENS
DATE 1/12/84
CHK BY
APP'D BY
INDUSTRIAL DRIVES
Radford, Virginia
A KOLLMORGEN DIVISION
FRAME ASSEMBLY SCHEMATIC
SBFP1
SCALE
PART LIST NO.
DWG NO. 80481

-CAUTION-

TO PREVENT DAMAGE TO SBD CARD, DO NOT CONNECT BUS CONNECTOR INTO MOTOR CONNECTION #12 ON SBD CARD



NOTES:

1. * DENOTES CUSTOMER FURNISHED COMPONENTS
2. THE STANDARD SINGLE BOARD AMPLIFIER WILL HAVE A RELAY OUTPUT.

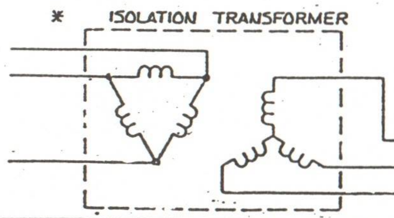
RELAY — 1 AMP 28 VDC RESISTIVE OR .5 AMP 120 VAC RESISTIVE.

3. 1Ø OR 3Ø TRANSFORMER SHOULD SELECTED FOR SYSTEM REQUIREMENTS AND TO LIMIT THE MAXIMUM INRUSH CURRENT TO 1000 AMPS. (AVAILABLE FROM INDUSTRIAL DRIVES)
4. SECONDARY VOLTAGE (DEPENDS ON SYSTEM) REFER TO MANUFACTER FOR MAXIMUM VOLTAGE.
5. 3Ø INPUT FUSE SHOULD BE SELECTED FOR SYSTEM REQUIREMENTS.
6. CUSTOMER HOOK-UP TO I/O, OUTPUT AND LS IS 18 AWG AND MOTOR IS 12 AWG.

FUNCTION	RELAY	OPERATIONAL DESCRIPTION	STD. OR OPT. FUNCTION
ENABLE	NO	CLOSE TO ENABLE	STANDARD
TORQ HOLD	NO	CLOSE TO ENABLE	STANDARD
EXT LIMIT	NO	CLOSE TO ENABLE	STANDARD
DIR LIMIT CW / CCW	NC / NC	OPEN TO INHIBIT	OPTIONAL
COMP SWITCH	NO	COMP 1	OPTIONAL
	NC	COMP 2	OPTIONAL

ALL FUNCTIONS REQUIRE SINK OF 2 MA @ .4 VOLTS WHEN CLOSED

7. CONNECTOR I/O PIN 9 AND OUTPUT PIN 2 ARE USED TO KEY CONNECTORS.



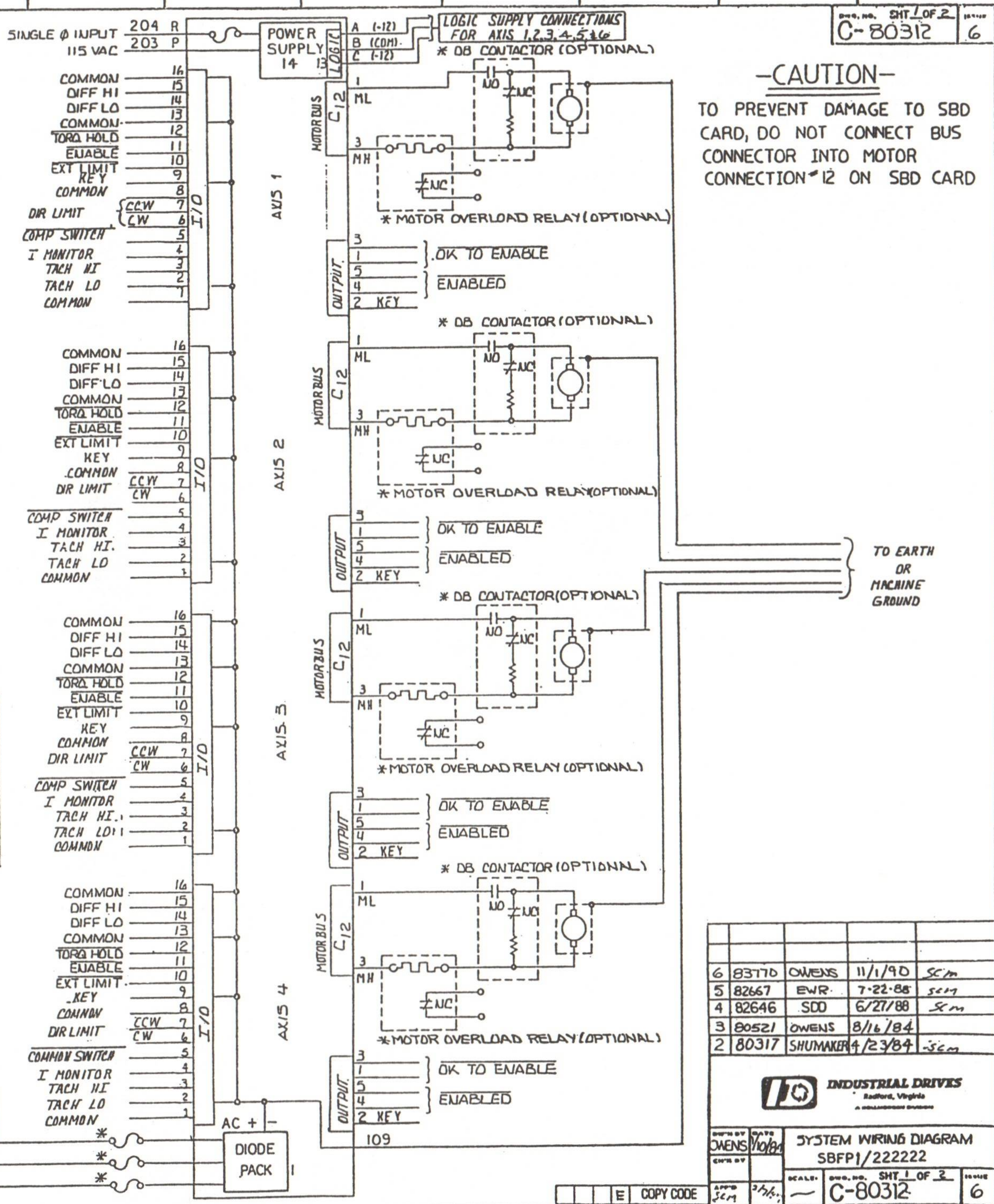
9	83770	OWENS	11/1/90	SCM
8	83006	SDD	3-22-89	SCM
7	82660	SDD	7/12/88	SCM
6	82532	SDD	4/25/88	SCM
5	80521	OWENS	8/16/84	
4	80435	GEARHEART	7-6-84	SCM
3	80317	SHUMAKER	4/23/84	SCM
2	80123	OWENS	12/20/83	SCM

INDUSTRIAL DRIVES Radford, Virginia

SYSTEM WIRING DIAGRAM SBFP1/2222

TDG · C-80275 SHT 1 OF 1 · 9

COPY CODE E



NOTES:

1. * DENOTES CUSTOMER FURNISHED COMPONENTS
2. THE STANDARD SINGLE BOARD AMPLIFIER WILL HAVE A RELAY OUTPUT.

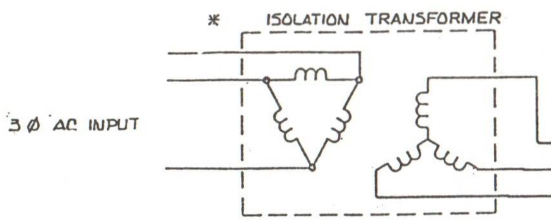
RELAY — 1 AMP 28 VDC RESISTIVE OR .5 AMP 120 VAC RESISTIVE.

3. 1Ø OR 3Ø TRANSFORMER SHOULD SELECTED FOR SYSTEM REQUIREMENTS AND TO LIMIT THE MAXIMUM INRUSH CURRENT TO 1000 AMPS. (AVAILABLE FROM INDUSTRIAL DRIVES)
4. SECONDARY VOLTAGE (DEPENDS ON SYSTEM) REFER TO MANUFACTER FOR MAXIMUM VOLTAGE.
5. 3Ø INPUT FUSE SHOULD BE SELECTED FOR SYSTEM REQUIREMENTS.
6. CUSTOMER HOOK-UP TO I/O, OUTPUT AND LS IS 18 AWG AND MOTOR IS 12 AWG.

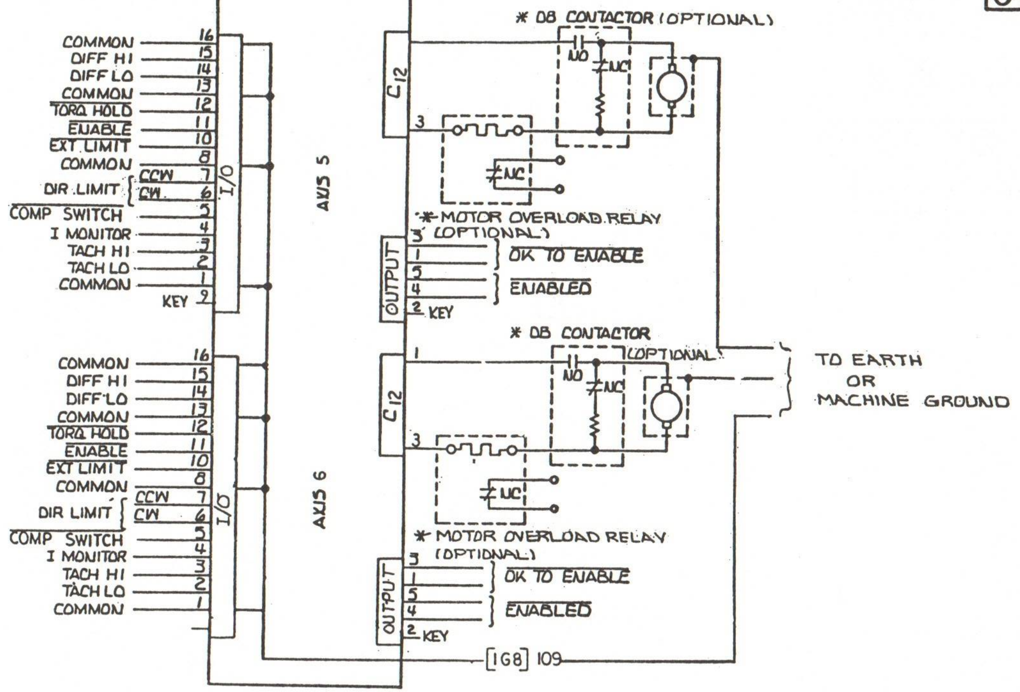
FUNCTION	RELAY	OPERATIONAL DESCRIPTION	STD. OR OPT. FUNCTION
ENABLE	NO	CLOSE TO ENABLE	STANDARD
TORQ HOLD	NO	CLOSE TO ENABLE	STANDARD
EXT LIMIT	NO	CLOSE TO ENABLE	STANDARD
DIR LIMIT CW / CCW	NC / NC	OPEN TO INHIBIT	OPTIONAL
COMP SWITCH	NO	COMP 1	OPTIONAL
	NC	COMP 2	OPTIONAL

ALL FUNCTIONS REQUIRE SINK OF 2 MA @ .4 VOLTS WHEN CLOSED

7. CONNECTOR I/O PIN 9 AND OUTPUT PIN 2 ARE USED TO KEY CONNECTORS.



DWG. NO. C-80312 SHT 2 OF 2 ISSUE 6



INDUSTRIAL DRIVES
Radford, Virginia

DWN BY: OWENS	DATE: 1/10/84	SYSTEM WIRING DIAGRAM SBFP1/222222
CHK'D BY		SCALE: ~
APP'D		DWG. NO. C-80312 SHT 2 OF 2 ISSUE 6

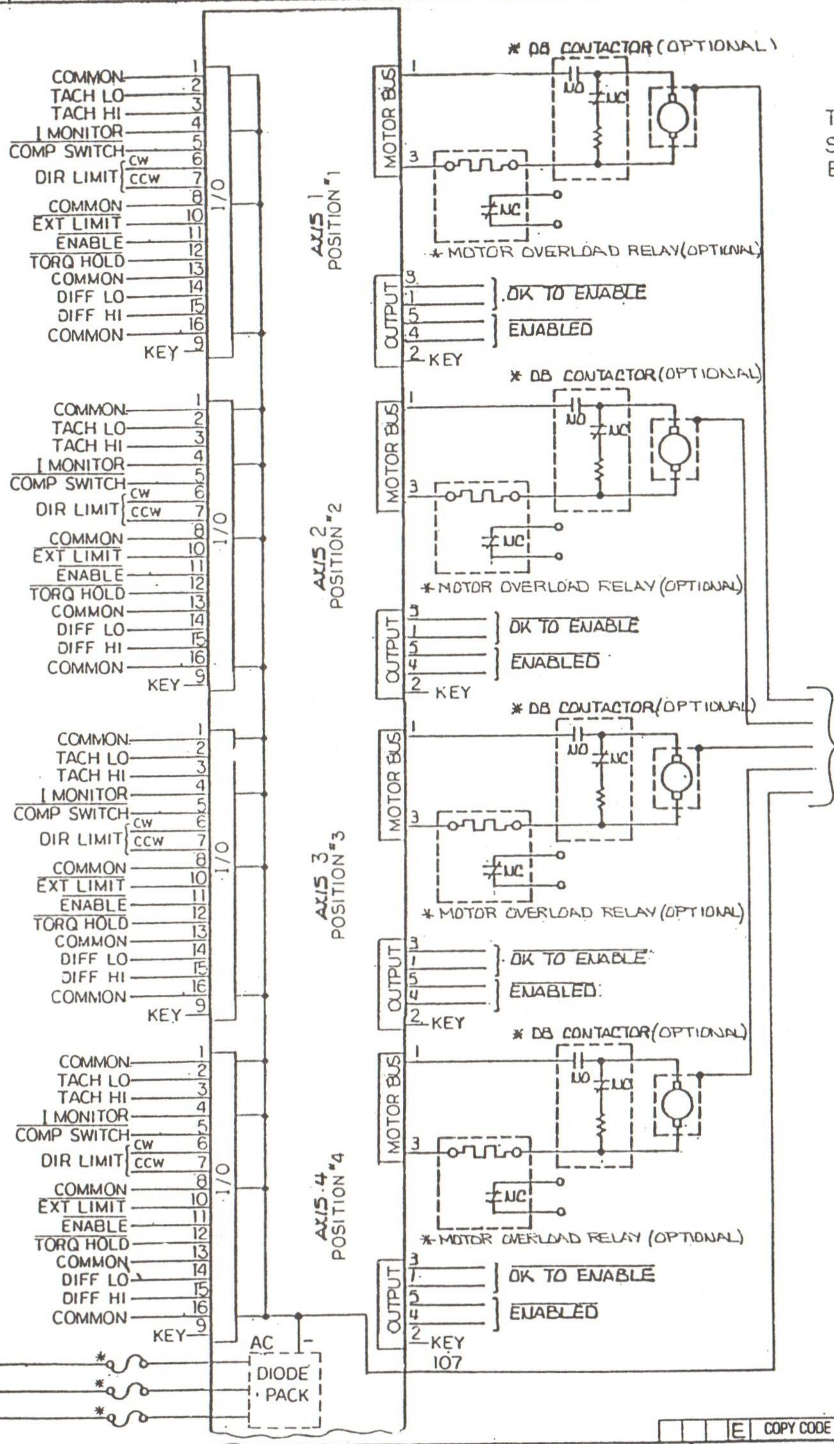
FUNCTION	RELAY	OPERATIONAL DESCRIPTION	STD. OR OPT. FUNCTION
ENABLE	NO	CLOSE TO ENABLE	STANDARD
TORQ. HOLD	NO	CLOSE TO ENABLE	STANDARD
EXT LIMIT	NO	CLOSE TO ENABLE	STANDARD
DIR LIMIT { CW / CCW	NC / NC	OPEN TO INHIBIT	OPTIONAL
COMP SWITCH { NO / NC	NO / NC	COMP 1 / COMP 2	OPTIONAL / OPTIONAL
ALL FUNCTIONS REQUIRE SINK OF 2 MA @ 4 VOLTS WHEN CLOSED			

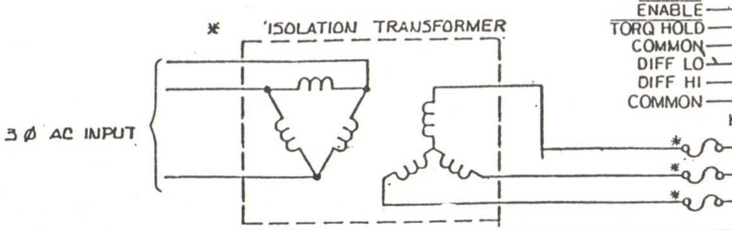
NOTES:

1. * DENOTES CUSTOMER FURNISHED COMPONENTS
2. THE STANDARD SINGLE BOARD AMPLIFIER WILL HAVE AN RELAY. OUTPUT FOR OK TO ENABLE AND ENABLE.

   RELAY — 1 AMP 28 VDC RESISTIVE OR .5 AMP 120 VAC RESISTIVE.

3. 1Ø OR 3Ø TRANSFORMER SHOULD BE SELECTED FOR SYSTEM REQUIREMENTS AND TO LIMITS THE MAXIMUM INRUSH CURRENT TO 1000 AMPS. (AVAILABLE FROM INDUSTRIAL DRIVES)
4. SECONDARY VOLTAGE (DEPENDS ON SYSTEM) REFER TO. MANUFACTER FOR MAXIMUM VOLTAGE.
5. 3Ø INPUT FUSE SHOULD BE SELECTED FOR SYSTEM REQUIREMENTS.
6. CUSTOMER HOOK-UP TO I/O, OUTPUT & LS IS 18 AWG AND MOTOR IS 12 AWG.





-CAUTION-

TO PREVENT DAMAGE TO SBD CARD. DO NOT INTERCHANGE BUS & MOTOR CONNECTIONS!

3	83770	OWENS	11/1/90	SCM
2	82787	SDD	10/17/88	SCM

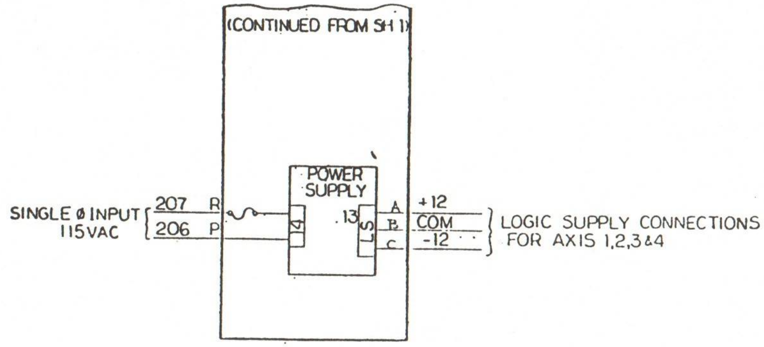
INDUSTRIAL DRIVES
Radford, Virginia

SYSTEM WIRING DIAGRAM
SBFP3/2222R

DWG. NO. C-81615 SHT 1 OF 2 ISSUE 3

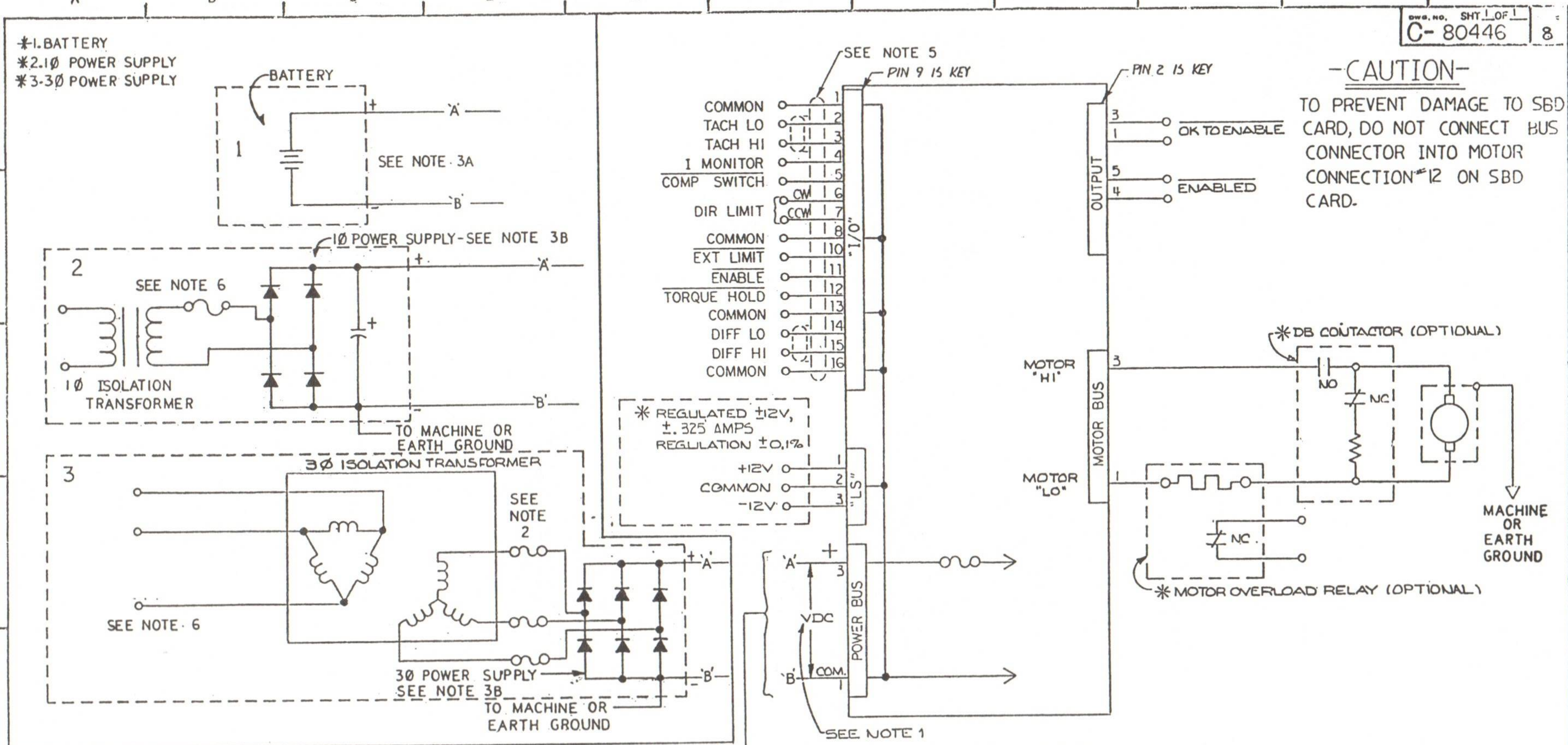
E COPY CODE

C-81615 SHT 2 OF 2 ISSUE 3



INDUSTRIAL DRIVES
Radford, Virginia
A KOLLMORGEN DIVISION

DWN BY: EWR
DATE: 10/23/85
SYSTEM WIRING DIAGRAM
SBFP3/2222R
SCALE: ~
DWG. NO. C-81615
SHT 2 OF 2
ISSUE 3



3 METHODS OF DERIVING DC BUS - SEE NOTE 3

NOTES:

* CUSTOMER FURNISHED.

① VDC: SBD2-XX-1XXX = 80 - 160, SBD2-XX-2XXX = 105 - 225
THE SELECTION OF THE SIZE AND VOLTAGE RATING OF C IS A FUNCTION OF THE SYSTEM REQUIREMENT WITH THE FOLLOWING GENERAL RULES:

A) THE CAPACITANCE VALUE SHOULD LIMIT THE RATIO OF THE PEAK TO AVERAGE VOLTAGE TO 10% OR LESS.

B) THE CAPACITANCE VALUE SHOULD LIMIT THE BUS TO A 10 TO 15% DROP DURING HIGH ACCEL. OPERATION.

C) THE CAPACITANCE VALUE SHOULD LIMIT THE RISE IN THE BUS VOLTAGE DURING MOTOR DECEL. TO AN ADDITIONAL 40 VOLTS ABOVE ITS NORMAL VALUE.

② INPUT FUSES SHOULD BE SELECTED FOR SYSTEM REQUIREMENTS.

③ DC BUS MAY BE SUPPLIED BY THE CUSTOMER BY ONE OF THE FOLLOWING:
(A)-BATTERY-REFER TO AMPLIFIER MODEL NO. FOR MAX. BUS VOLTAGE.
(B)-3Ø DC POWER SUPPLY OR 1Ø DC POWER SUPPLY. (TRANSFORMER AVAILABLE FROM INDUSTRIAL DRIVES.)

④ THE STANDARD SINGLE BOARD AMPLIFIER WILL HAVE A RELAY OUTPUT FOR OK TO ENABLE AND ENABLED. AN OPTOCOUPLER OUTPUT IS OPTIONAL.
RELAY — 1 AMP 28 VDC RESISTIVE OR .5 AMP 120 VAC RESISTIVE.

⑤ SHIELDED CABLE IS RECOMMENDED FOR CUSTOMER CONNECTION TO CONNECTOR #1. TACH HI & LO AND DIFF HI & LO SHOULD USE SHIELDED PAIRS. SHIELDS ARE TO BE TERMINATED TO EITHER MACHINE OR EARTH GROUND, OR I/O CONNECTOR, BUT NOT TO ALL OF THEM. ONE END OF SHIELD TO BE OPEN AND INSULATED.

⑥ SECONDARY VOLTAGE L-L WILL DETERMINE DC BUS VOLTAGE. CONSULT FACTORY.

⑦ BUS OF POWER SUPPLY MUST BE CONNECTED TO MACHINE OR EARTH GROUND.

CONNECTOR	FUNCTION	RELAY	OPERATIONAL DESCRIPTION	STD. OR OPT.	FUNCTION
"I/O"	ENABLE	NO	CLOSE TO ENABLE	STANDARD	INPUT
	TORQ HOLD	NO	CLOSE TO ENABLE	STANDARD	INPUT
	EXT LIMIT	NO	CLOSE TO ENABLE	STANDARD	INPUT
	DIR LIMIT { CW / CCW	NC / NC	OPEN TO INHIBIT	OPTIONAL	INPUT
	COMP SWITCH	NO	CLOSE TO ENABLE COMP2	OPTIONAL	INPUT
OUTPUT	OK TO ENABLE	NO	CLOSE FOR NO FAULT DETECTED	STANDARD	OUTPUT
	ENABLED	NO	CLOSE FOR NO FAULT DETECTED AND AMPLIFIER ENABLED.	STANDARD	OUTPUT

ALL FUNCTIONS REQUIRE SINK OF 2 ma @ .4 VOLTS WHEN CLOSED.

8	83770	OWENS	11/1/90	SCM
7	83573	OWENS	4/5/90	SCM
6	82667	EWR	7-22-88	SCM
5	82277	SDD	8-20-87	SCM
4	81070	GEARHEART	7-4-85	SCM
3	80674	SHUMAKER	11/13/84	SCM
2	80521	OWENS	8/15/84	SCM

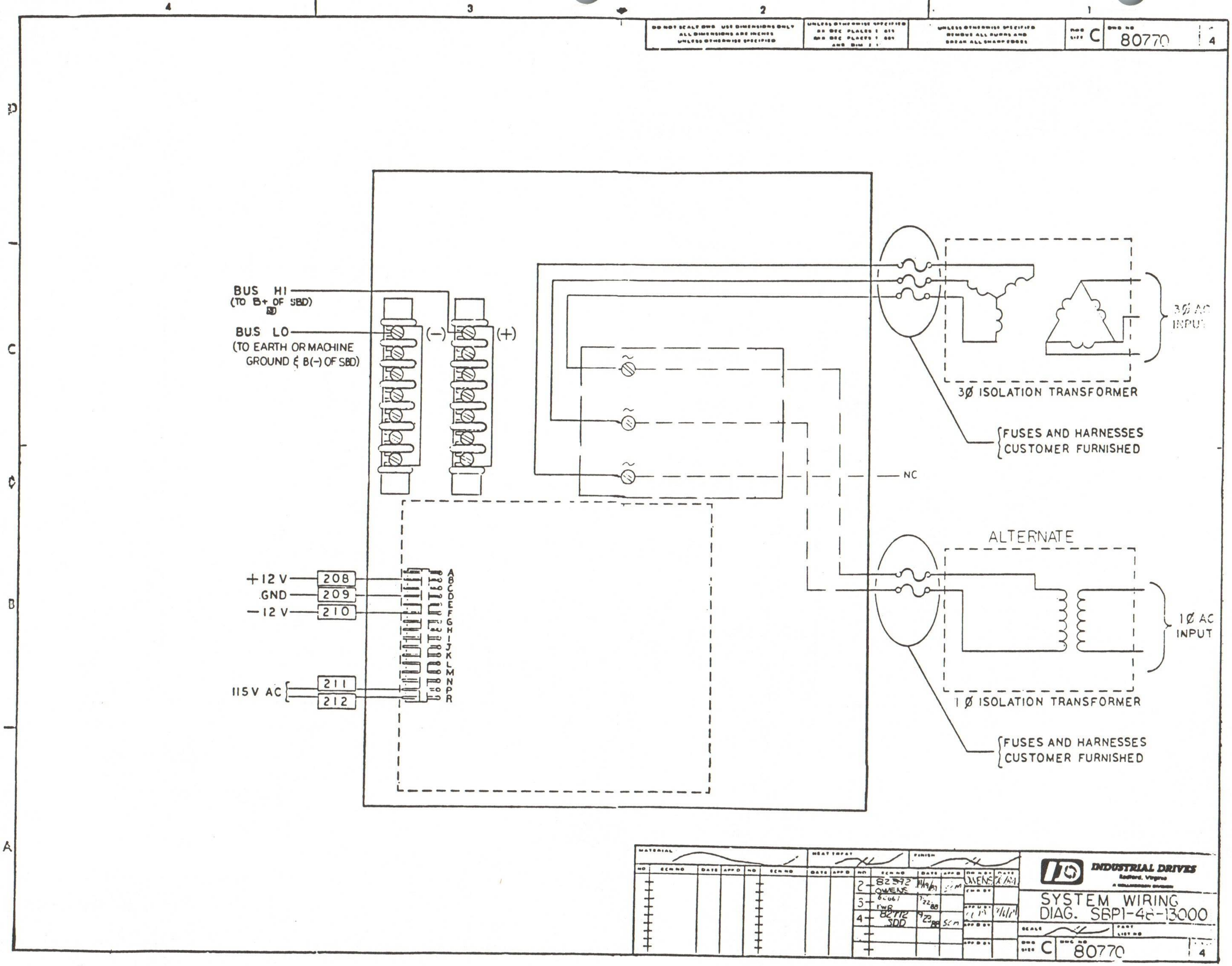
E COPY CODE

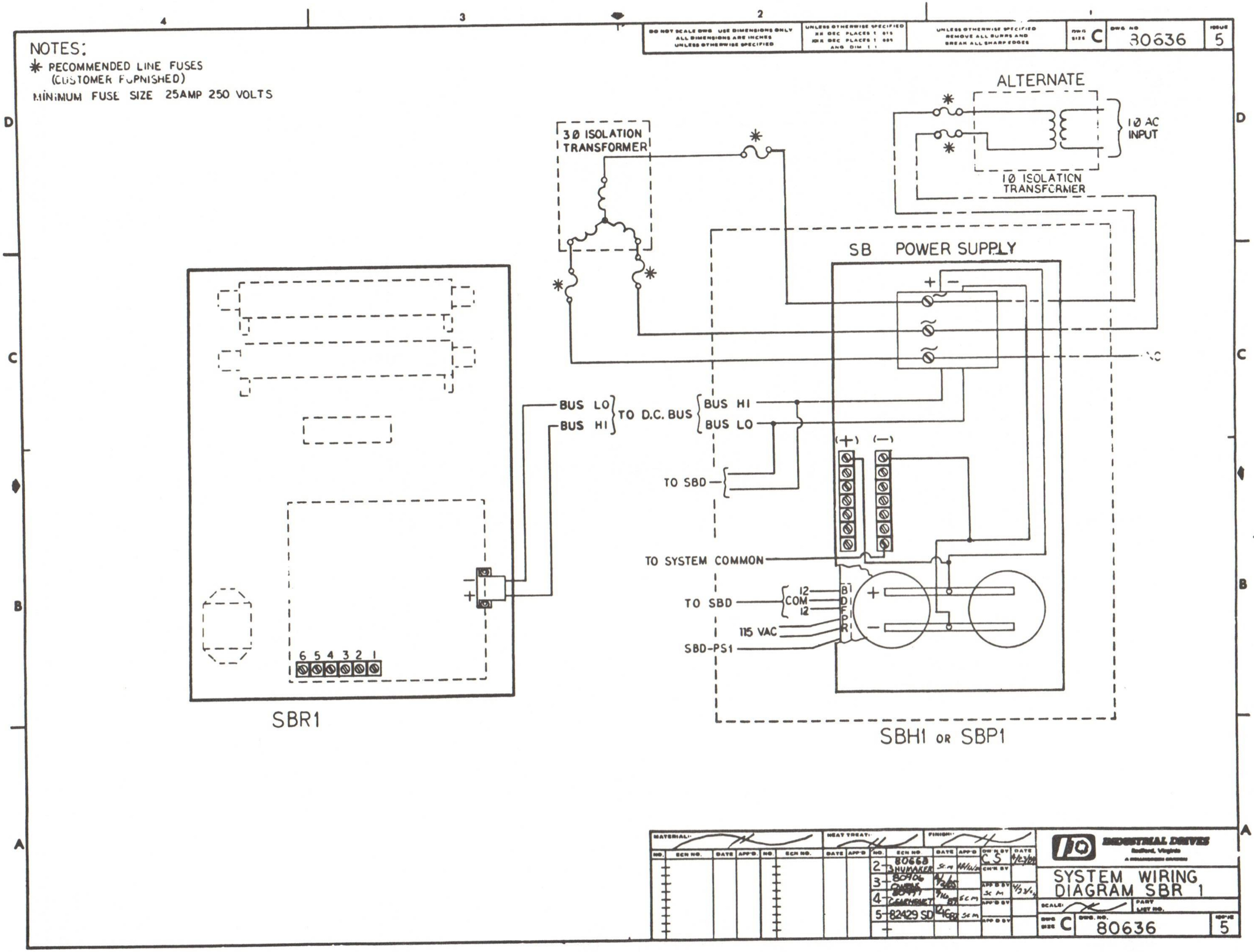
INDUSTRIAL DRIVES
Radford, Virginia

DRN BY: DIRICO DATE: 12/88 CHK BY: APP'D: SCM 11/11/94

SYSTEM WIRING DIAGRAM SBD2

SCALE: ~ DWG. NO. C-80446 SHT 1 OF 1 REV 8


BUS HI
(TO B+ OF SBD)
BUS LO
(TO EARTH OR MACHINE
GROUND & B(-) OF SBD)
(−)
(+)
NC
+12 V
GND
−12 V
115 V AC
208
209
210
211
212
A B C D E F G H I J K L M N P R
3Ø AC INPUT
3Ø ISOLATION TRANSFORMER
FUSES AND HARNESSES
CUSTOMER FURNISHED
ALTERNATE
1Ø AC
INPUT
1 Ø ISOLATION TRANSFORMER
FUSES AND HARNESSES
CUSTOMER FURNISHED
INDUSTRIAL DRIVES
Radford, Virginia
SYSTEM WIRING
DIAG. SBP1-48-13000
C
80770
4

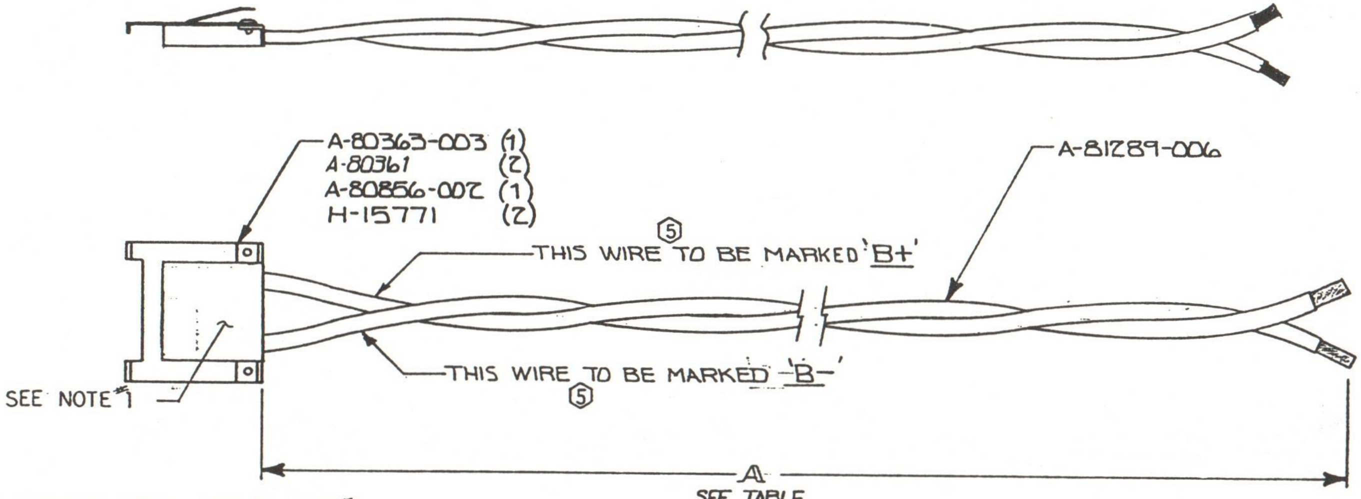

NOTES:
* RECOMMENDED LINE FUSES
(CUSTOMER FURNISHED)
MINIMUM FUSE SIZE 25AMP 250 VOLTS
DO NOT SCALE DWG USE DIMENSIONS ONLY
ALL DIMENSIONS ARE INCHES
UNLESS OTHERWISE SPECIFIED
UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS AND
BREAK ALL SHARP EDGES
C
30636
5
ALTERNATE
1Ø AC
INPUT
1Ø ISOLATION
TRANSFORMER
3Ø ISOLATION
TRANSFORMER
SB POWER SUPPLY
+
−
BUS LO
BUS HI
TO D.C. BUS
BUS HI
BUS LO
TO SBD
(+)
(−)
TO SYSTEM COMMON
TO SBD
12
COM
12
B
D
F
P
R
115 VAC
SBD-PS1
+
−
6 5 4 3 2 1
SBR1
SBH1 OR SBP1
MATERIAL:
HEAT TREAT:
FINISH:
NO.
ECN NO.
DATE
APP'D
2
80668
3
HUMAKER
80706
4
82429 SD
5
C S
INDUSTRIAL DRIVES
Radford, Virginia
SYSTEM WIRING
DIAGRAM SBR 1
SCALE:
PART
LIST NO.
DWG
SIZE
C
DWG. NO.
80636
ISSUE
5

DO NOT SCALE DWG. USE DIMENSIONS ONLY. ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED XX DEC. PLACES ± .015 XXX DEC. PLACES ± .005 ANG. DIM. ± 1°

UNLESS OTHERWISE SPECIFIED REMOVE ALL BURRS AND BREAK ALL SHARP EDGES

DWG. SIZE B | DWG. NO. 80746 | ISSUE 5



NOTES:
1)-MARK THIS SURFACE WITH THE NUMBER #15

DASH NO.	DIM A	DASH NO.	DIM A
001	3FT.	009	27FT
002	6FT.	010	30FT
003	9FT.	011	33FT
004	12FT.	012	36FT
005	15FT.		
006	18FT.		
007	21FT.		
008	24FT		

MATERIAL: | HEAT TREAT: | FINISH:

NO.	ECN NO.	DATE	APP'D.
2	80521 OWENS	8/14/84	SCM
3	80553 SLIDER	8/30/84	SCM
4	81050 M.WILSON	7/4/85	OWB
5	82681 OWENS	7/24/88	SCM

DW'N BY LLS DATE 7/18/84
CH'K BY OWENS 7/18/84
APP'D BY SCM 7/19/84
APP'D BY
APP'D BY

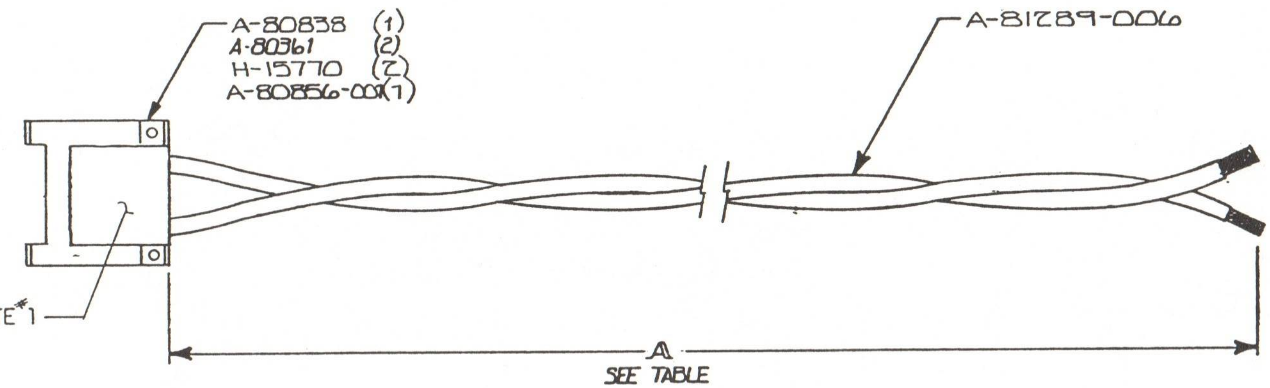
KOLLMORGEN CORPORATION
INDUSTRIAL DRIVES DIVISION
RADFORD, VIRGINIA

CONNECTOR KIT-BUS SBC2

SCALE: | PART LIST NO.

DWG. SIZE B | DWG. NO. 80746 | ISSUE 5

DO NOT SCALE DWG. USE DIMENSIONS ONLY. ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE SPECIFIED	UNLESS OTHERWISE SPECIFIED XX DEC. PLACES ± .015 XXX DEC. PLACES ± .005 ANG. DIM. ± 1°	UNLESS OTHERWISE SPECIFIED REMOVE ALL BURRS AND BREAK ALL SHARP EDGES	DWG. SIZE B	DWG. NO. 80781	ISSUE 4



NOTES:
1)-MARK THIS SURFACE WITH THE NUMBER #12.

DASH NO.	DIM A	DASH NO.	DIM A
001	3FT.	009	27FT
002	6FT.	010	30FT
003	9FT.	011	33FT
004	12FT.	012	36FT
005	15FT.	013	39FT
006	18FT.	014	42FT
007	21FT.	015	45FT
008	24FT.	016	48FT

MATERIAL: HEAT TREAT: FINISH:

NO.	ECN NO.	DATE	APP'D.
2	80553 SNIDER	9/4/84	SCM
3	81050 M. WILSON	1/4/85	OWENS
4	83397 MHE	11/27/89	SCM

DW'N BY OWENS DATE 8/10/84
CH'K BY
APP'D BY SCM 8/15/84
APP'D BY
APP'D BY

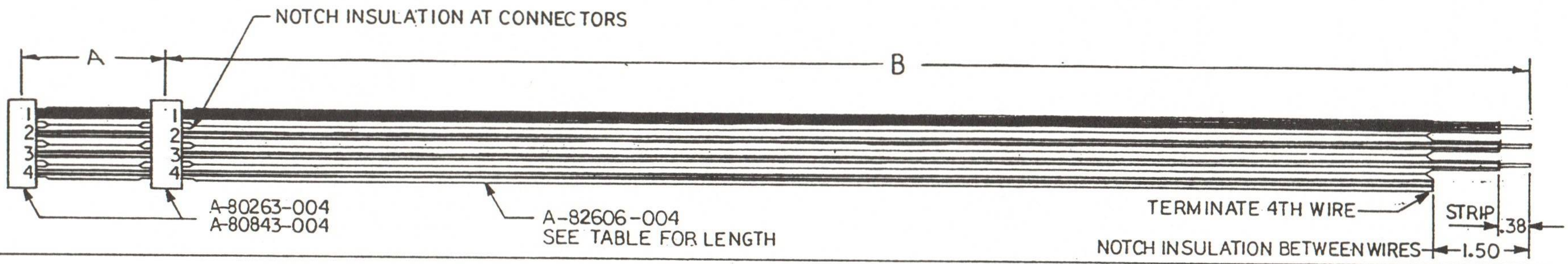
KC KOLLMORGEN CORPORATION
INDUSTRIAL DRIVES DIVISION
RADFORD, VIRGINIA

CONNECTOR KIT-MOTOR SBC2

SCALE: PART LIST NO.

DWG. SIZE B DWG. NO 80781 ISSUE 4

DO NOT SCALE DWG. USE DIMENSIONS ONLY. ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE SPECIFIED	UNLESS OTHERWISE SPECIFIED XX DEC. PLACES ± .015 XXX DEC. PLACES ± .005 ANG. DIM. ± 1°	UNLESS OTHERWISE SPECIFIED REMOVE ALL BURRS AND BREAK ALL SHARP EDGES	DWG. SIZE B	DWG. NO. 8199D	ISSUE 2



SPACING TABLE

DASH NO.	A	B
-001	—	6"

MATERIAL: —	HEAT TREAT: —	FINISH: —

NO.	ECN NO.	DATE	APP'D.
2	82266 SD	8/11/87	SCM

DW'N BY	DATE
OWENS	2-13-8?
CH'K BY	
APP'D BY	
SCM	2-14-87
APP'D BY	
APP'D BY	

INDUSTRIAL DRIVES
Radford, Virginia
A KOLLMORGEN DIVISION

LOGIC CABLE ASS'Y.
SBP1-15

SCALE: —	PART LIST NO.
DWG. SIZE B	DWG. NO. 8199D	ISSUE 2

INDUSTRIAL DRIVES DIVISION
TEST LIMIT AND MODIFICATION SHEET
SINGLE BOARD DRIVE AMPLIFIER
SBD-COMP 2

TL SBD2-POK10122-2/160-20
ISSUE 1 SH 1 OF 1
WRITTEN BY B. Dalton 8/1/90
APPROVED BY B. Dalton 8/2/90

MOTOR PORTER K-10122
INDUCTOR N/A
OVERLOAD RELAY AA21P HEATER FH-39
MAX. OPERATING SPEED 300 RPM
1ST BREAK POINT 65 +/- 18 RPM
2ND BREAK POINT 180 +/- 36 RPM
LO SPEED PEAK CURRENT 36 TO 44 AMPS
HI SPEED PEAK CURRENT 8 TO 12 AMPS
FOLDBACK CURRENT 18 TO 22 AMPS
OVERSPEED 345 +/- 30 RPM
EXT. CURRENT LIMIT 9 TO 12 AMPS
LOAD INERTIA .01841 LB.FT.SEC^2

****
* TEST DEPT. INFO.
* BREAK TOLERANCES + 20%
* TACH MEASURED AT I/O
* CONNECTOR 3-3; TACH HI.
*
* 9.4 V TACH = MAX SPEED
* 10.7 V TACH = OVR SPEED
* 2.04V TACH = 1ST BREAK
* 5.67V TACH = 2ND BREAK
*
* TACH = 31.5V/1000 RPM
* BEMF = 365V/1000 RPM
*
* 8 VOLT INPUT = MAX SPEED
* _ VOLT INPUT = __ + __ A
****

AMPLIFIER SCALING:
R9 51.1K
R10 30.1K
R1A 40.2K

CURRENT LIMIT RESISTOR: R23 43.2K
OPTIONAL CURRENT FOLDBACK:
D21 OPEN R22 OPEN

~~EXT. CUR. LIMIT: R27 47.5K~~
DIR. LIMIT CUR. LIMIT: D24 OPEN

TACH SCALING:	R11	16.2K		
TACH LEAD:	R12	10K	C15	.39mf
RATE LAG.	R8	100K	C16	.22mf
	R7	49.9K	C14	.15mf
VEL. FILTER:	C4	OPEN	C3	OPEN
HP. CONTOUR:	R25	11K	D26	IN5225B
	R30	2K	D20A	IN5247B
	R31	1K	D32	OPEN
ABS SCALING:	R13	100 OHMS		
CUR. LEAD :	R20	20K	C18	.033mf
CUR. LAG :	R6	25.5K	C17	.033mf
	R5	332K	C19	.0033mf
OVERSPEED :	R1	2.21K	R2	6.81K

SPECIAL INSTRUCTIONS:

ECN: ______________________________

INDUSTRIAL DRIVES
TEST LIMITS AND MODIFICATION DATA
SBD-COMP 2

TL SBD2-POK10122-2/160-20
ISSUE 1 SH 2 OF 2

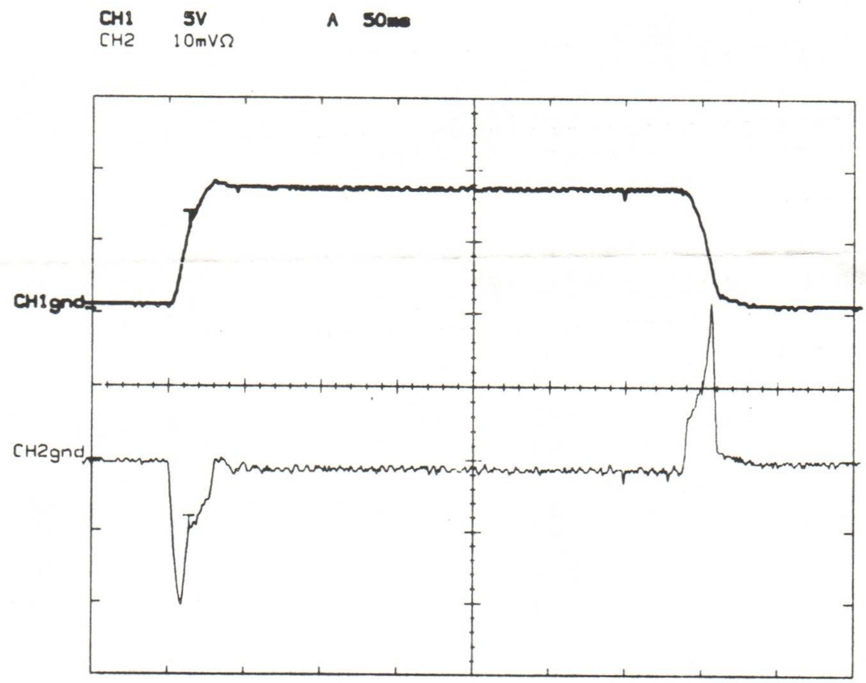
SPECIAL INSTRUCTIONS AND COMMENTS:

ACCEL/DECEL
@ 300 RPM

LOAD INERTIA
.0184 LB.FT.SEC^2

20 A/DIV.

50 MS/DIV.



Stamp SBD-COMP2 Card, in box provided, with amplifier current rating and motor compensation.

Example: POK10122-2/160-20-1